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ABSTRACT

As part of the basic training program in police traffic services intended to establish a national standard, the student study guide was developed to serve as a basic reference text to reinforce and supplement the subject material presented in class. The document consists of the six following major sections: (1) background for policy traffic services, (2) traffic law, (3) traffic direction and control, (4) traffic law enforcement, (5) accident management, and (6) traffic court. (VA)

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police traffic services
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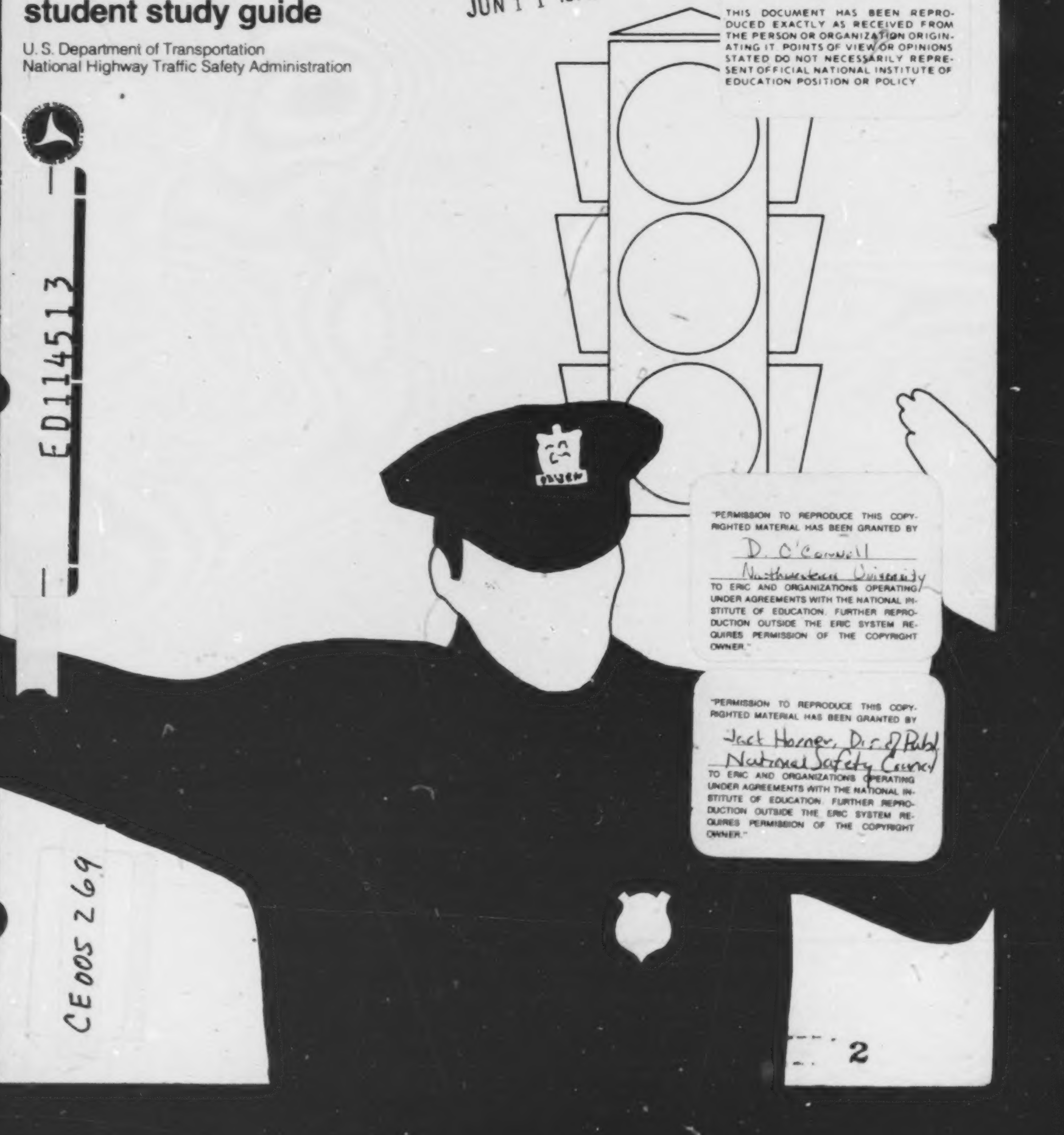

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volume 3 of 3

police traffic services
basic training program

student study guide

U. S. Department of Transportation
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October 1972

YT-102-040

FOREWORD

As part of a concerted effort by the U.S. Department of Transportation to improve and upgrade the effectiveness of their nationwide highway safety program, this "Basic Training Program for Police Traffic Services" has been developed. The intent of this program is to establish a national guideline and uniform basis for jurisdictional law enforcement training establishments to provide basic training in police traffic services.

The documents constituting this training program are:

- Course Guide - developed to aid in the organization and conduct of the training program
- Instructor's Lesson Plans - prepared to provide the instructor with an organized and explicit framework for the delivery of the training content of this course
- Student Study Guide - designed to serve as the basic reference source for the students/trainees

All documents for this training program were prepared by Mr. Allen Hale (Project Director) and Mr. John W. Hamilton of Dunlap and Associates, Inc., under the cognizance of Mr. Joseph T. Fucigna, Executive Vice President of the Corporation.

ACKNOWLEDGMENTS

Dunlap and Associates, Inc., appreciates the assistance and encouragement received during our developmental effort from Dr. Aaron Adams (Manpower Development Division), our Contract Technical Manager, and Mr. Richard Youngs (Traffic Regulations and Adjudication Division) of the National Highway Traffic Safety Administration. We wish to acknowledge the contribution of our consultants, listed below, who have provided valuable technical review of draft materials:

- Lieutenant Colonel William E. Armstrong (Baltimore City Police Department, Retired) -- Maryland Police Training Commission; Pikesville, Maryland.
- Mr. Norman R. Johnson -- Iowa Law Enforcement Academy; Johnston, Iowa.

We are indebted to Mr. Roger P. Quane, and Lieutenant Colonel W.E. Armstrong of the Maryland Police Commission for making the arrangements for the conduct of the pilot test of this curriculum, as well as serving as instructors during the pilot test. We also thank the Baltimore City Police Academy for providing facilities and material in support of the pilot test program. Students who participated in the pilot test were: Charles Franklin Penrow, Jr. (Aberdeen Proving Grounds); Patrolmen William L. Morrow, William D. Carr, Robert Lee Daniels, John Joseph Sturgis, Chauncey Earl Whittle (Baltimore City Public Schools); Patrolmen David Leroy Cotter, Linwood Daye, William Lee Hendrick, Donald Jackson, Joseph Edward Lamartina, Isaac Elisha McGinnis, Gerald Anthony Roberts, Hubert A. Ross, George F. Whittle (University of Maryland - Baltimore Campus); Patrolmen Robert Nathan Brenner III, Dexter Alan Housel, Craig Albert Reynolds, Eugene Benson Smith, and James A. Weamert III (University of Maryland - College Park Campus).

Finally, we wish to thank all of the law enforcement training agencies from the state, county and municipal levels listed below, which provided information about and/or copies of their police traffic services training materials for our review:

Arkansas

- Arkansas Law Enforcement Training Academy

California

- California Highway Patrol
- Department of Criminal Justice, Sacramento State College
- Los Angeles Sheriff's Academy
- Training Division, Los Angeles Police Department

Connecticut

- Connecticut State Police Training Academy
- Manchester Community College
- Municipal Police Training Council

Delaware

- Delaware State Police Training Academy

Florida

- Florida Institute of Criminal Justice, Central Florida Community College
- Training Center, Miami Police Department

Georgia

- Georgia Police Academy

Illinois

- Illinois State Highway Police Academy
- Traffic Institute, Northwestern University
- Training Division, Chicago Police Department

Kansas

- Kansas Law Enforcement Training Center, University of Kansas

Maryland

- International Association of Chiefs of Police
- Maryland Police Training Commission
- Maryland State Police Academy

Michigan

- Training Division, Michigan State Police

Missouri

- Greater St. Louis Police Academy

Nebraska

- Department of Law Enforcement and Corrections, University of Nebraska

New York

- New York City Police Academy
- New York State Police Academy
- Training Division, Nassau County Police Department

North Carolina

- Occupational Education Division, Department of Community Colleges, State Board of Education
- Training and Inspection Division, North Carolina State Highway Patrol

Ohio

- Columbus Police Department
- Ohio State Highway Patrol Academy
- Trade and Industrial Education Service, Ohio State Division of Vocational Education

Pennsylvania

- Pennsylvania State Police Academy

Texas

- Personnel and Training Branch, Texas Department of Police Safety

Utah

- Utah Police Academy

Washington State

- Washington State Patrol Academy
- Trade and Industrial Section, Washington State Division of Vocational Education

PURPOSE OF THE GUIDE

This document is intended to serve as a basic reference text to reinforce and supplement the subject material presented in class. As selected topics are introduced in class, the conscientious trainee will do well to review the relevant portions of this document, as well as his notes taken in class. The trainee should always bring the Study Guide to each class session, as certain exhibits herein will be referred to during the course of instruction.

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ASSEMBLING THE STUDENT STUDY GUIDE

Note: Since this page and the two following pages contain instructions for local assembly of the Student Study Guide, they should be removed from the guide prior to its distribution to the students.

The traffic laws and ordinances, departmental operating procedures and forms and breath screening/sampling equipment used by the patrolmen will vary jurisdictionally. It is necessary to include reference material related to these subjects in any student textbook or reference source for the course. No single available reference text will meet the unique requirements of this course and therefore a Student Study Guide has been prepared to serve as a student reference source. Most of the material for the Study Guide has already been prepared, insofar as it is considered to be generic content for all law enforcement jurisdictions. However, certain materials should be included in the Study Guide which are jursidictionally specific. They must be prepared/procured and inserted at the end of appropriate sections of all Study Guides used by the local training establishment. All such materials to be inserted in the Study Guide are itemized below:

Study Guide Section	Material to be Prepared and/or Procured and Inserted
2.0 Traffic Laws	. Copy of the jurisdictional traffic laws and ordinances, annotated with relevant court rulings and precedents which define and interpret the law. (This material may be handled as a separate handout for training purposes.)
3.0 Traffic Direction and Control	. Traffic Institute, Northwestern University. Signals and gestures. Traffic Direction Series. Evanston, Illinois: Author, 1960*
	. Traffic Institute, Northwestern University. Directing vehicle movements. Traffic Direction Series. Evanston, Illinois: Author, 1961.
4.0 Traffic Law Enforcement	. Traffic Institute, Northwestern University. Stopping and approaching the traffic violator. Traffic Law Enforcement Series. Evanston, Illinois: Author, 1958.
	. Traffic Institute, Northwestern University. Officer-violator relationships. Traffic Law Offenses Series. Evanston, Illinois: Author, 1969.
	. Traffic Institute, Northwestern University. Taking enforcement action. Traffic Law Enforcement Series. Evanston, Illinois: Author, 1958.
	. Blank copies or facsimiles of the traffic law enforcement forms used in the

---

* All of the documents referenced in this section may be obtained from the Traffic Institute; Northwestern University; 405 Church Street; Evanston, Illinois, 60204. At the time of publication, single document prices do not exceed $1.00. A volume purchase discount is available

Insert page 2

4.0 Traffic Law Enforcement (cont'd)	jurisdiction, along with checklists for their completion (e. g., written warning, traffic citation/summons, parking citation/summons, arrest record, alcoholic/drug influence report form, chemical test request, chemical test refused, equipment repair order, daily activity report, etc.)* . Operating manual/instructions for breath screening/sampling equipment . Standard operating procedures for processing a person suspected of driving while under the influence of alcohol or drugs
5.0 Accident Management	. Blank copies or facsimiles of the forms/envelopes used in connection with accident management along with checklists for their completion (e. g., police accident report, supplementary accident report, written statement, personal property, vehicle impounding, photographic data, physical evidence, etc.)

---

* All forms and other exhibits inserted in the Study Guide by the training establishment should receive a sequential exhibit number for identification purposes.

Insert page 3

Section 1.0

BACKGROUND FOR POLICE TRAFFIC SERVICES

BACKGROUND FOR POLICE TRAFFIC SERVICES

Definition of Police Traffic Services

The term "police traffic services" includes several major functions for which the patrolman will be responsible in varying degrees. The major functions and their related objectives are listed below:

- Traffic direction and control
  - Expedite the safe movement of vehicular and pedestrian traffic
  - Relieve traffic congestion on roads and highways
  - Secure compliance with traffic laws
- Traffic law enforcement
  - Promote sustained compliance with traffic laws through deterrence
  - Prevent hazardous traffic situations from occurring and thus prevent or reduce traffic accidents
- Accident management
  - Render first aid as necessary to the victims of a traffic accident and establish safe passage for roadway traffic
  - Document the facts surrounding an accident
  - Determine the cause (s) of an accident
  - Take any warranted law enforcement action
  - Normalize the roadway environment affected by the traffic accident
- Preparation and presentation of courtroom evidence
  - Present all relevant evidence, in a fair and impartial manner, to support the State's/People's case against an accused traffic offender
  - Enable the just adjudication of the guilt or innocence of an accused traffic offender

- Services for motorists
  - Provide or make arrangements for assistance to disabled or distressed motorists

Highway Transportation System

When the patrolman is performing police traffic services, he is in fact concerned with monitoring, supervising and regulating the elements of the "highway transportation system." The three major elements of this system are listed below:

- Trafficway
- Motor vehicle
- People
  - Driver (conveyance operator)
  - Pedestrian

Trafficway. It is readily apparent that construction of roadways has been extensive and yet continues. Highway/traffic engineers are designing highways that allow for safer and more efficient travel. About 28,700 miles of the interstate highway system were completed as of 1970, and this limited access highway system continues to develop; considering the vast amount of travel mileage that this system presently carries (156,934,000,000 miles in 1970), it is the safest form of highway on which to travel.

Motor vehicle. The number of registered vehicles has and continues to grow steadily each year. In 1900, there were only about 8,000 privately owned motor vehicles in the entire country. By 1920, 9.25 million vehicles were registered. In 1930, the number of registered motor vehicles rose to 26.75 million. By 1961, there were approximately 63 million registered vehicles (a ratio of 2.4 persons per passenger car, 1.4 licensed drivers per passenger car). In 1970, 111.5 million vehicles were registered in the U.S. (a ratio of 1.5 licensed drivers per vehicle).

The performance of motor vehicles, in terms of power available and handling characteristics, has generally improved over the years with recent trends being toward a sacrifice of available horsepower to achieve lower levels of pollutants in engine exhaust emissions.

The safety features of motor vehicles have been receiving more design attention in recent years, including the research and development of such items as:

- Driver/passenger restraints
  - Seatbelts, harnesses
  - Air bags
- Padded dashboards
- Safety glass
- Strengthened, more crash resistant vehicular construction
- Strengthened road tires

People. The capability of the human element of the highway transportation is maximized through education, training, and regulation. As of 1971, the laws of 47 states require formal examination of applicants prior to obtaining a driver's license; most states require testing of an applicant's capability in the following areas:

- Visual acuity/depth perception
- Understanding of traffic control devices
- Knowledge of traffic laws and safe driving practices
- Ability to control the vehicle (road test)

Many communities offer formalized driver education and training programs as a part of their secondary school curriculum; commercial driving schools are another source of driver education and training; some states require successful completion of a formalized driver education course in addition to passing the state administered driver examination.

Close examination of traffic accident statistics reveals that traffic accidents are frequently the result of one or more violations of traffic laws and often the violation is the result of illegal and hazardous driving behavior, as opposed to vehicular or highway condition. It is therefore the consensus of highway safety experts that it is the human element of the highway transportation system which needs the greatest attention to improve highway safety, in terms of:

- Better driver education and training programs
- Greater public education with respect to traffic laws and highway safety

- More stringent regulation of drivers
  - Update and refinement of traffic laws
  - Update and refinement of driver licensing and vehicle registration requirements
  - Rigorous and impartial enforcement of traffic laws by the police

Highway Safety Problem

Since police traffic services are directed toward promoting the safe and expeditious movement of highway traffic, the patrolman should have an appreciation of the scope of the major problem in accomplishing these objectives, namely, motor-vehicle accidents. A review of the highlights of recent motor vehicle accident statistics, as compiled by the National Safety Council, follows:

Motor vehicle deaths versus war deaths. In all the wars in the history of the U.S., from the Revolutionary War beginning in 1775 to the Viet Nam conflict through 1970, the related casualities number approximately 1,152,000. In the period of 1900 through 1970, U.S. motor vehicle deaths totaled more than 1,800,000.

Highlights of 1970 motor vehicle accident statistics. As a result of motor vehicle accidents, there were 54,800 fatalities, and 2,000,000 injuries (disabling beyond the day of the accident). Of the 54,800 motor vehicle accident fatalities occurring in 1970, 23,300 were the result of collisions between motor vehicles; 14,200 were the result of noncollisions in roadway, overturning, or running off roadway; 10,400 were pedestrian accidents; 4,450 were the result of collisions with fixed objects; 1,530 were the result of collisions with railroad trains; 820 were the result of collisions with bicycles; 100 were the result of "other collisions" such as collisions with animals, animal drawn conveyances, etc.

Of the 54,800 deaths in 1970, approximately 17,500 occurred in urban areas and 37,300 occurred in rural areas. Nearly two thirds of all pedestrian deaths occur in urban areas.

Of the 2,000,000 injuries sustained in 1970, 1,230,000 occurred in urban areas and 770,000 in rural areas.

Fatal accidents occur most frequently during the following hours:

- Weekdays, except rush hour on Friday
- Friday, late at night
- Saturday, late afternoon and night
- Sunday, early morning

Drinking while driving is indicated as being a factor in at least one half of the fatal motor vehicle accidents (27,400). According to reports for 1970, three out of ten fatal accidents involved excessive speed (too fast for the conditions). This was a factor in nearly one third of all rural fatal accidents and a factor in nearly one fourth of urban fatal accidents.

Section 2.0

TRAFFIC LAW

TRAFFIC LAW

Origin and Purpose of Traffic Laws

Emergence of the motor vehicle. What is generally considered to be the first American gasoline-engine powered automobile was built in 1893 by the Duryea brothers of Springfield, Missouri. Mass production methods for automobiles were introduced as early as 1901. By 1901, American factories were able to produce 181,000 passenger cars and 6,000 trucks and buses in one year.

Opposition to the automobile. When the presence of the automobile was felt on the roads of the U.S., it was initially resented because of its disruptive effects on the prevalent horse-drawn conveyances. The noise generated by the early automobile frequently caused horses to rear and run away. However by 1927, the results of the process of displacement of horse drawn transportation by automobiles had become quite apparent.

Need to regulate traffic. With the advent of the automobile co-mingling and competing with pedestrian and horse drawn traffic, it became necessary to acknowledge the rights of people to use the streets and highway. The courts started to take official notice of the "equal rights" of individuals to use highways as early as 1907, with the formal notion being that "all persons, whether afoot or using some sort of lawful conveyance, have reciprocal rights in the use of streets and highways, and, except as regulated by statute or ordinance, none has superior rights over the others." Unless specifically regulated by state statute, the doctrine of equal rights extends to motor vehicle operators, pedestrians, bicycle and motorcycle riders, horseback riders, operators of horsedrawn wagons or carriages and even to people driving cattle, horses or other domestic animals along the road.

With the meteoric rise of the automobile in terms of greater numbers of high-power vehicles with great speed capability, highway fatalities rose in alarming proportion. During the year 1941, 39,969 persons were killed in traffic accidents. Prior to this time, there had been great concern with the building of safer and more efficient highways. It became apparent about this time that a greater effort needed to be placed upon the driver in the highway system.

With the emphasis upon the human element, greater concern turned towards the development of more effective rules governing the traffic situation. Traffic rules, laws and regulations are intended primarily for the prevention of traffic accidents, while at the same time allowing for the orderly and expeditious flow of traffic on an equitable basis for all concerned. Simply stated, traffic laws, especially the rules of the road, are safe driving practices in written form. It follows that traffic laws, to be effective in reducing accidents, must be enforced in an impartial and conscientious manner by law enforcement agencies.

Development of Traffic Laws

Early traffic laws were geared to controlling automobiles insofar as they represented a threat or menace to pedestrian and horse based transportation. As the motor vehicle started to assume a dominant role on the highways and streets, the legislative concern gradually turned toward the equitable and safe regulation of all forms of highway traffic.

Cities and towns were the first forms of government to develop traffic laws. The states slowly followed municipal initiative and sought to standardize basic traffic laws within the state. Ultimately, efforts began on the development of a means to standardize traffic laws throughout the country. Some traffic regulation milestones of importance were:

1899 - Boston closed their parks to automobile traffic between certain hours of the day to reduce accidents due to runaway horses.

1901 - Connecticut passed the world's first automobile speed statute.

1901 - New York required automobile registration

1904 - New York law declared that its provisions regulating the operation of motor vehicles should be controlling throughout the state (municipal ordinance must not conflict with the state law on the same subject).

1907 - Connecticut passed the first driver license law

1924 - The notion of nationwide guidelines for uniform traffic laws was born; the "Uniform Vehicle Code" was to combine the best features of existing traffic laws into an integrated body of model laws and ordinances.

1926 - The draft of the first Uniform Vehicle Code was approved; subsequent revisions to this original document have been made with the latest being in 1968. The agency concerned with the update and modification of the Uniform Vehicle Code is the National Committee on Uniform Traffic Laws and Ordinances in Washington, D.C.

1935 - The original edition of the "Manual on Uniform Traffic Control Devices" was published; this national guideline document has been periodically revised with the latest revision being in 1971.

1946 - With traffic fatalities reaching alarming proportions, the President called the First Annual Conference on Highway Safety. Recommendations for improvements in the following areas were made by the action committee:

- Laws and ordinances
- Public information and education
- Police traffic supervision
- Traffic courts
- Traffic engineering
- Traffic accident records
- Organized citizen support
- Motor vehicle administration
- Highway research

1950's - Most traffic accident prevention experts concluded traffic accidents and resultant injuries, fatalities and property damage will be minimized if the following are accomplished:

- Equitable, understandable and enforceable traffic laws are enacted
- Police officers become skilled in the detection and apprehension of traffic violators
- The courts are administered by personnel who appreciate the importance of traffic law enforcement

Nature of Traffic Laws

Traffic laws (state statutes and municipal ordinances) specify the various traffic violations/offenses for which the patrolman will be responsible for enforcing. A traffic offense/violation is a designation (phrase) given for the group of elements which constitute a violation of a particular section of the traffic laws or vehicle code. Some traffic offenses take the form of failure to perform a required procedure (e. g., stop for a stop sign). Other traffic offenses take the form of committing an act forbidden by law (e. g., exceeding the posted speed limit). The elements of a traffic offense are the observable conditions or behaviors that must be present or have occurred in order for a traffic offense to have been committed. The elements of each offense are found in the traffic laws. For instance, the elements of the offense of "driving under the influence of alcohol" are typically the following:

- Suspect was driving, operating or in physical control of a motor vehicle
- Suspect was under the influence of alcohol

The patrolman must account for all the elements of a traffic offense before the violation can be charged and the elements of a traffic offense must be proved by the prosecution in court. It is essential that the patrolman have a clear working understanding of the jurisdictional traffic laws (the classes of offenses and their elements) as well as the departmental enforcement policy to be effective in the field in detecting traffic offenses.

In contrast to certain aspects of criminal laws, traffic laws do not mention the "intent" of the violator as having a bearing on the enforcement of a traffic offense. Traffic laws ordinarily make certain acts (of omission or commission) unlawful, irrespective of the "state of mind" of the violator. This would, therefore, make irrelevant the following excuses often offered by traffic violators:

- I didn't intend to... (go that fast, run that stop sign, etc.)
- I didn't know I was... (going that fast, running with a headlight out, etc.)

Therefore, as a rule, the "intent," attitude, or personality of a suspected violator should never be a consideration for the patrolman in determining if traffic law enforcement action should be taken and, if so, what kind. The logic behind this is that a reasonable person never really intends to willingly violate laws designed to protect his own well-being and that of others. An exception to this philosophy is the charge of "reckless driving." The facts surrounding the offense must show that the driver had an attitude and displayed conduct indicative of a wanton disregard for the rights and safety of others.

Traffic laws must be enforced regardless of whether a hazardous situation exists at the time of an infraction. For example, a motorist's contention that there was no traffic present when he ran through a stop sign should have no bearing on the law enforcement action by the patrolman. An analysis of accident experience indicates that people do not always perceive hazardous situations in a timely fashion; it is therefore a dangerous policy to require compliance with traffic laws only when hazardous situations are present.

Section 3.0

TRAFFIC DIRECTION AND CONTROL

Introduction

Definitions. Traffic direction and control (TDC) is the part of police traffic services that involves telling drivers and pedestrians how, where, and when they may or may not move or stand at a particular place, especially during periods of congestion or in emergencies; generally, all police activities necessary to insure a smooth and orderly flow of traffic. The key words are how and where and when traffic can move. The control of vehicular and pedestrian movement by police at a particular place such as an intersection is known as point traffic control.

Routine police function. A routine police duty of practically all patrolmen is to conduct TDC. The utilization of traffic signs, signals and roadway markings helps the motorist and pedestrian under "normal" traffic conditions. However, the patrolman is still required, when human judgment is necessary, to handle unusual traffic flow situations. Therefore, TDC is performed by the patrolman assigned to a beat, as well as the patrolman in the police car.

TDC objectives. The primary objectives that a patrolman is expected to fulfill while conducting TDC are as follows:

- Expedite the safe movement of vehicular and pedestrian traffic
- Relieve congestion on roads and highways
- Secure compliance with traffic laws

Situations requiring TDC. There are many situations where patrolmen must apply TDC techniques and procedures. Some of these situations are as follows:

- "Rush hour" traffic, namely the daily time periods people require to go from home to work and return
- Peak hours of business at shopping and/or business areas, which could occur several times during the day as well as during evening hours
- Twice daily school traffic

- Special or unusual situations:
  - Accident scenes
  - Fires or disaster areas
  - Special events
    - Parade
    - Sport arena, race track
    - Other
  - Hazardous scenes
    - Construction areas
    - Fallen trees
    - Downed lamp post/power lines
    - Improperly/illegally parked vehicles
    - Other
  - Escort of special traffic
    - Oversized loads
    - Military convoys
    - VIP vehicles
    - Funerals
    - Parades
    - Dangerous or valuable cargo
    - Other

Responsibilities

Performance requirements. The patrolman is responsible for expediting the safe and smooth flow of vehicular/pedestrian traffic when he is assigned to a station or when he detects a traffic problem. Specifically, he is required to:

- Regulate cross flow
  - North and South
  - East and West
- Control turning movements
- Detour traffic in emergencies

- Supervise signal obedience
  - When necessary, direct traffic to enhance traffic control
- Protect pedestrians
  - Prevent jaywalking
  - Other hazardous crossings
- Secure compliance with traffic laws
  - Prevent illegal parking
  - Enforce traffic laws
- Provide safe passage of emergency vehicles
  - When a conflict exists, priority should be given to the heavier vehicle
    - Fire truck
    - Ambulance
    - Police car
    - Tow truck
    - Other equipment
- Select routes for escorted traffic
- Give routing and traffic law information

Areas for conducting TDC. Point control traffic, where patrolmen make the decision as to who uses the roadways in what order, for how long and under what conditions, is usually performed at intersections. The directional flow can be any of the following: both streets two-way, both streets one-way, one street two-way, or between intersections. TDC is not limited to intersections. It can be performed on any type of roadway, which includes limited access highways.

Method of control. The methods a patrolman uses to direct traffic are fundamentally the same. It is the conditions that vary. A patrolman manually directs traffic by means of a standard set of signals and gestures. The patrolman can also supplement traffic control devices in situations where they are inadequate by manually controlling the device or supplementing traffic signals and/or signs by using signals and gestures. A detailed discussion of signals and gestures and their application is contained in Exhibits 3-2 and 3-3.

Traffic Engineering

Definition of traffic engineering (TE). The Institute of Traffic Engineers' defines TE as "that phase of engineering which deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon, as their use is related to the safe, convenient, and economic transportation of persons and goods." Some of the tasks for which the traffic engineer is responsible are:

- Conduct of roadway surveys to determine the volume, speed and destination of traffic
- Roadway design and layout installation of traffic signals, signs and pavement markings (traffic control devices)
- Parking regulation
- Establishment of traffic flow patterns, i.e., one-way streets, etc.
- Setting of speed limits for new roads and highways

The traffic engineering field is relatively new. The title of "traffic engineer" was first officially recognized in 1921 in the State of Ohio. Today, many small cities and towns still do not have a traffic engineer. Cities in the population category of 50,000 or smaller tend to rely on the police to fulfill the traffic engineering function. Usually one officer is delegated the responsibility and his cost is part of the police budget.

The individual officer's role in TE. Each police officer can help the traffic engineer to reduce traffic accidents and expedite the safe movement of traffic, since officers are in the best position to detect trafficway inadequacies. Typical examples of inadequacies and improvements which the patrolman can report are:

- A traffic control device which is obscured, damaged, or missing
- The need for a no parking zone near an intersection to facilitate traffic flow
- A street which needs new lane markings to facilitate traffic flow and prevent accidents

- A malfunctioning or inoperative traffic light
- Need to increase or decrease the intervals of a traffic light to aid in clearing a problematic intersection

All the suggestions might not be implemented. However, the patrolman should be alert to suggest improvements. The traffic engineer will determine the final action that will be taken based on factual justifications.

Traffic Control Devices

Definition. "Traffic control devices are all signs, signals, markings, and devices placed on or adjacent to a street or highway by authority of a body or official having jurisdiction to regulate, warn, or guide traffic."

Background. During 1850 in New York City, congestion on Broadway was a cause of great concern. The only control measures available were patrolmen, who sometimes had to resort to the use of the night stick to break up traffic jams.

The use of pavement marking dates back as far as 1600 to a highway built from Mexico City which had a built-in center line of contrasting color. About 1911, Wayne County, Michigan, applied the first white painted center line.

Efforts for achieving uniformity of traffic signs were made as early as 1908 by an International Road Congress which convened in Paris, France. However, the shapes, colors, and symbols bore no relation to American practice. In 1918, the first state-wide application of route number signs appeared in Wisconsin. In 1925, a committee on signs, signals, and markers was appointed. It selected the background color of yellow for signs as recommended by the Bureau of Standards. Also, the sign shapes of the square, diamond, circle and octagon were chosen.

The modern traffic control signal is considered to be a descendant of the manually operated semaphore, which was first used about 1910. The now familiar three color traffic light first appeared in New York City in 1918.

The need for traffic control devices became evident as motor vehicle traffic grew since it was not financially feasible for police to control traffic at the many required intersections at all hours of the day.

Requirements. The basic requirements that traffic control devices should meet are as follows:

- Meet the traffic requirements; i.e., fulfill a need
- Command attention
- Convey a clear, simple meaning
- Obtain the respect of the road user
- Allow sufficient time for the desired response

Operational features. To meet these requirements, the following operational features must be considered. The design must command attention by size, contrast, colors, shape, composition, lighting, or reflectorization. It should present a clear meaning by shape, size, colors, and simplicity of the message, allow adequate time for response by considering legibility, size, and placement and obtain road user respect by considering uniformity, reasonability of regulation, size, and legibility.

Placement of the device should command attention by considering the motorist's field of vision. The proper meaning should be conveyed by considering the place, object, or situation to which it pertains. The desired response should be obtained by considering the location, legibility, and normal driver speed.

Operation or application of the device should meet the traffic requirements at a given location. The device should be uniform and consistent for similar traffic control situations, such that motorists, patrolmen, and traffic courts have the same recognition and interpretation. Finally, the devices should be easily maintainable.

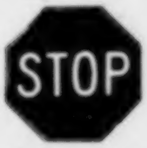
Future trends. Currently an effort is being made by the U.S. Department of Transportation to standardize traffic control devices throughout the United States. State highway authorities have been requested to conform to the recommended traffic control device standard within a reasonable period of time. This is to be accomplished by replacing existing traffic control devices as part of the maintenance program. New roads will have the new devices installed. Standardization should benefit motorists, patrolmen, and traffic courts.

Signs

There are three functional classes of signs: 1) regulatory signs, 2) warning signs, and 3) guide signs.

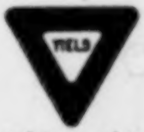
Regulatory signs. These signs specify traffic behavior which is enforceable by law. There are six basic groups of regulatory signs, dealing with right-of-way, speed, movement, parking, pedestrians, and miscellaneous situations. Examples of each are illustrated, in accordance with the standard, to familiarize the reader with the shape, size, and color of each displayed sign.

- Right-of-way signs, for example:



30" x 30"

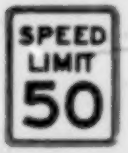
Stop sign--exclusively an octagon, white legend on red background



36" x 36" x 36"

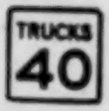
Yield sign--Equilateral triangle, red border and legend on white

- Speed series



24" x 30"

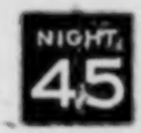
Rectangle--Black on white



24" x 24"

Rectangle--black on white

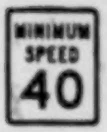
Speed limit



24" x 24"

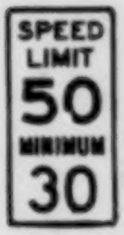
Rectangle, white on black

Night speed signs


MINIMUM
SPEED
40

24" x 30"

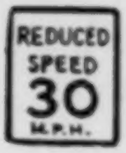
Rectangle, black on white


SPEED
LIMIT
50
MINIMUM
30

24" x 48"

Minimum speed signs

(Regulatory Signs - Cont.)

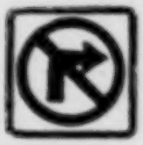

REDUCED
SPEED
30
M.P.H.

24" x 30"

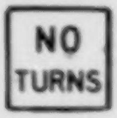
Rectangle, black on white

Reduced speed signs

Movement series, for example:

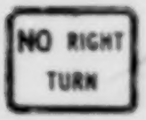


24" x 24"
(plus plaque)



24" x 24"

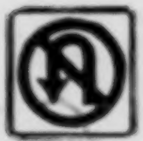
Square, circle and slash red
with black legend on white background


NO RIGHT
TURN

Rectangle, black on white

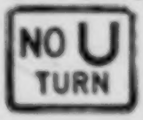
24" x 30"

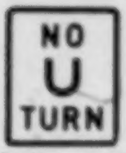
Turn prohibition signs



Square, circle and slash red with black legend
on white background

24" x 24"
(plus plaque)

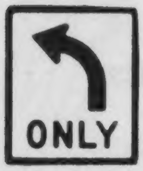




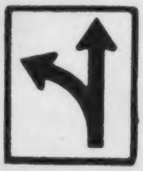
Rectangle, black on white

24" x 30"

U-turn prohibition signs

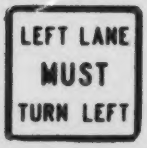


30" x 36"



30" x 36"

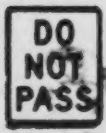
Rectangle, black on white


LEFT LANE
MUST
TURN LEFT

30" x 30"

Square, black on white

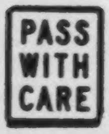
Lane use control signs



24" x 30"

Rectangle, black on white

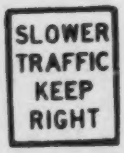
Do not pass signs


PASS
WITH
CARE

24" x 30"

Rectangle, black on white

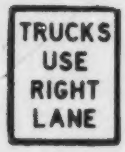
Pass with care signs


SLOWER
TRAFFIC
KEEP
RIGHT

24" x 30"

Rectangle, black on white

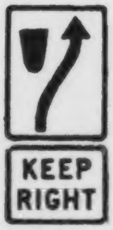
Slower traffic keep right signs


TRUCKS
USE
RIGHT
LANE

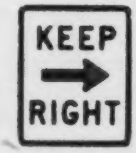
24" x 30"

Rectangle, black on white

Uphill traffic lane signs



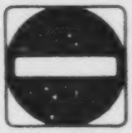
24" x 30"
(plus plaque)



24" x 30"

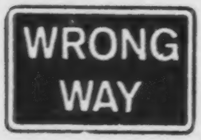
Rectangle, black on white

Keep right signs



30" x 30"

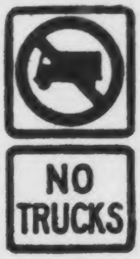
Square, white on red



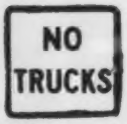
30" x 24"

Rectangle, white on red

Wrong way signs



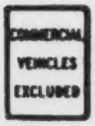
24" x 24"
(plus plaque)



24" x 24"

Square, circle and slash red with black legend, background white

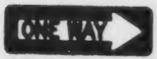
Exclusion signs


COMMERCIAL
VEHICLES
EXCLUDED

Rectangle, black on white

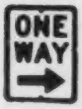
24" x 30"

Exclusion signs (Cont.)



Rectangle, white on black

36" x 12"

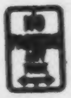


Rectangle, black on white

18" x 24"

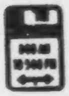
One-way signs

- Parking series, for example:



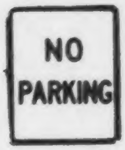
Rectangle, red on white

12" x 18"



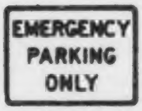
Rectangle, green on white

12" x 18"



Rectangle, red on white

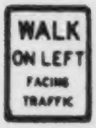
24" x 30"


EMERGENCY
PARKING
ONLY

Rectangle, black on white

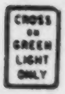
30" x 24"

- Pedestrian series, for example:


WALK
ON LEFT
FACING
TRAFFIC

18" x 24"

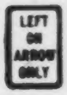
Rectangle, black on white


CROSS
ON
GREEN
LIGHT
ONLY

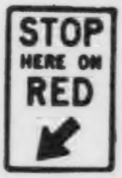
12" x 18"

Rectangle, black on white

- Miscellaneous series, for example:


LEFT
ON
ARROW
ONLY

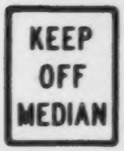
12" x 18"


STOP
HERE ON
RED

24" x 36"

Rectangle, black on white

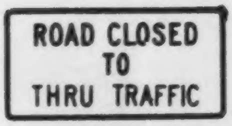
Traffic signal signs


KEEP
OFF
MEDIAN

24" x 30"

Rectangle, black on white

Keep off median signs


ROAD CLOSED
TO
THRU TRAFFIC

60" x 30"

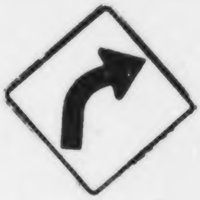
Rectangle, black on white

Road closed signs

Warning signs. The purpose of warning signs is to warn traffic of existing or potentially hazardous conditions on or adjacent to a highway or street. Warning signs imply that the motorist should apply the necessary safety precautions for his own safety as well as for other motorists and/ or pedestrians. Consequently, warning signs are a great assistance to the motorists since they safeguard and expedite traffic.

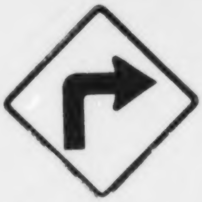
Warning signs are typically diamond shaped, and have a background color of yellow with a black legend. Exceptions to the diamond shape are a large arrow in a horizontal rectangle; traffic signal ahead sign- a yellow, green and black signal head symbol on a yellow diamond; advisory speed plate- a square with a black legend and a yellow background; no passing zone sign- a pennant shaped sign with a black legend and yellow background. The following illustrations are examples of warning signs.

- Warning for horizontal alignment changes



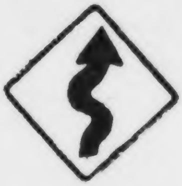
30" x 30"

Curve



30" x 30"

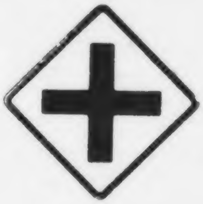
Turn



30" x 30"

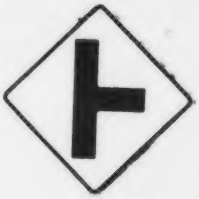
Winding Road

- Intersections



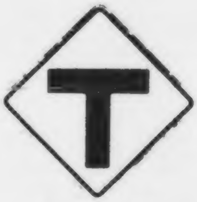
30" x 30"

Crossroads



30" x 30"

Side Road

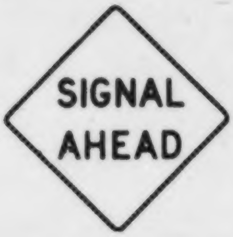


30" x 30"

T-Intersection

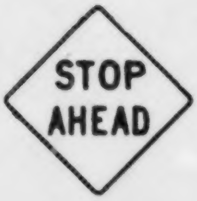
(Warning Signs - Cont.)

- Advance warning of traffic control devices


SIGNAL
AHEAD

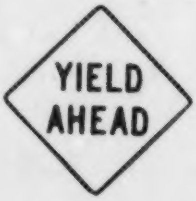
36" x 36"

Signal Ahead



30" x 30"

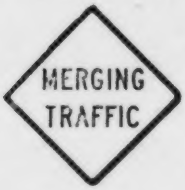
Stop Ahead


YIELD
AHEAD

30" x 30"

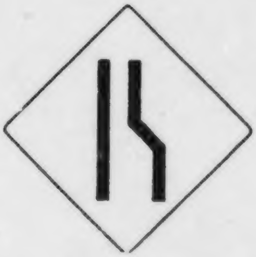
Yield Ahead

- Converging lanes


MERGING
TRAFFIC

30" x 30"

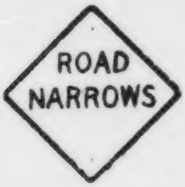
Merging Traffic



36" x 36"

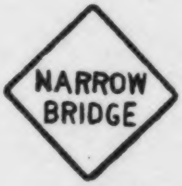
Pavement Width Transition

- Narrow roadways


ROAD
NARROWS

36" x 36"

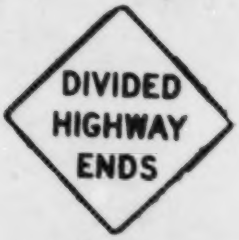
Road Narrows


NARROW
BRIDGE

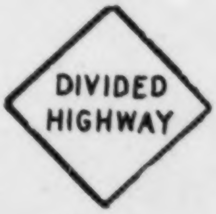
30" x 30"

Narrow Bridge

- Highway design changes

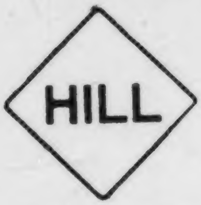

DIVIDED
HIGHWAY
ENDS

36" x 36"
Divided Highway Ends

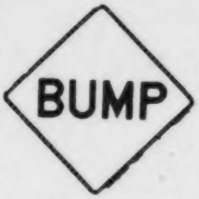

DIVIDED
HIGHWAY

36" x 36"
Divided Highway

- Grade changes

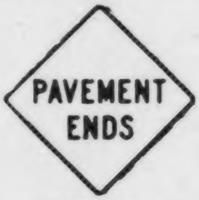


30" x 30"
Hill

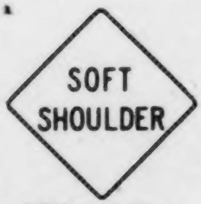


30" x 30"
Bump

- Roadway surface conditions

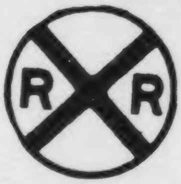

PAVEMENT
ENDS

30" x 30"
Pavement Ends


SOFT
SHOULDER

30" x 30"
Soft Shoulder

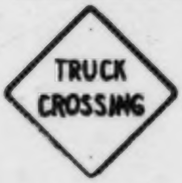
- Railroad crossings



36" Diameter

Railroad Advance Warning

- Entrances and crossing of traffic



30" x 30"

Truck Crossing

- Other (low clearance, advisory speed plate, etc.)

Guide signs. The purpose of guide signs is primarily to provide the motorist with information which will aid him in selecting the simplest and most direct manner to go from one point to another. Typical conventional road guide signs include the following.

- Arrows and symbols. Downward arrows on overhead signs are used only to identify traffic lanes for specific traffic routes. Arrows which point upward or at an upward angle on overhead signs are used to direct traffic to an exit roadway.

  On roadside signs for straight-through movement, the arrow points upward. For turns, the arrow points upward at an angle which best describes the intersection. Horizontal arrows are appropriate at right angle intersections.

- Numbered and marked highway systems. The American Association of State Officials assigns numbers to the Interstate and U.S. systems upon recommendation of the state highway officials. State and county roads are numbered by the appropriate authority. Typical guide signs include U.S. route markers, state route markers, junction markers, alternate route markers, temporary markers, destination and mileage signs and other guide signs.

- Expressway/freeway signs. Typical functions for expressway/freeway signs are to display destinations, give advance notice, of the approach to intersections and interchanges, provide appropriate lane control and route markings, state distance to destinations, provide motorists service information and other miscellaneous information.

Sign colors. The recommended colors that should be used for signs are summarized below. Color conflicts currently exist in some jurisdictions; however, these should be in accordance with U.S. Department of Transportation standards in the near future.

- Red is the background color for stop signs, multi-way supplemental plates, do not enter messages, and wrong way signs. It is also used as a legend for parking prohibition signs, route markers, circular outline and diagonal bar prohibitory symbols, and the border and message for yield signs.

- Black is the background color on one-way, certain weigh station, and night speed limit signs. Black is used to display the message on white, yellow, and orange signs.

- White is the background color for route markers, guide signs, fallout shelter directional signs, and regulatory signs (excluding stop signs). It is also the legend color on brown, green, blue, black and red signs.

- Orange is the background color for construction and maintenance signs.

- Yellow is the background color for most warning signs.

- Brown is the background color for guide and information signs of recreational scenic or cultural interest.

- Green is the background color for guide signs, mile posts and the legend color for permissive parking signs.

- Blue is the background color for information signs pertaining to motorists services.

- Other colors reserved for future use.

Signals

Definition of traffic signals. Traffic signals are designed to operate manually, electrically and/or mechanically to aid the flow of vehicular and pedestrian traffic by alternatively controlling the stopping and proceeding of the traffic flow. The overall objective of the traffic signal is to facilitate the safe movement of traffic through an intersection with minimum delay.

Advantages of traffic signals. Traffic signals provide for orderly movement of traffic and reduce certain types of accidents, particularly right angle collisions. When they are properly coordinated with other signals, they permit almost a continuous flow of traffic at reasonable speeds. In addition, they provide for the safe crossing or entering gaps by interrupting heavier traffic flow and are more efficient and economical than manual control.

Disadvantages of traffic signals. Traffic lights can have disadvantages for if they are unwarranted, ill-designed, ineffectively placed, improperly operated, or poorly maintained, they can cause excessive delays, traffic violations, use of alternate, less adequate routes and an increase in accidents, especially the rear-end type.

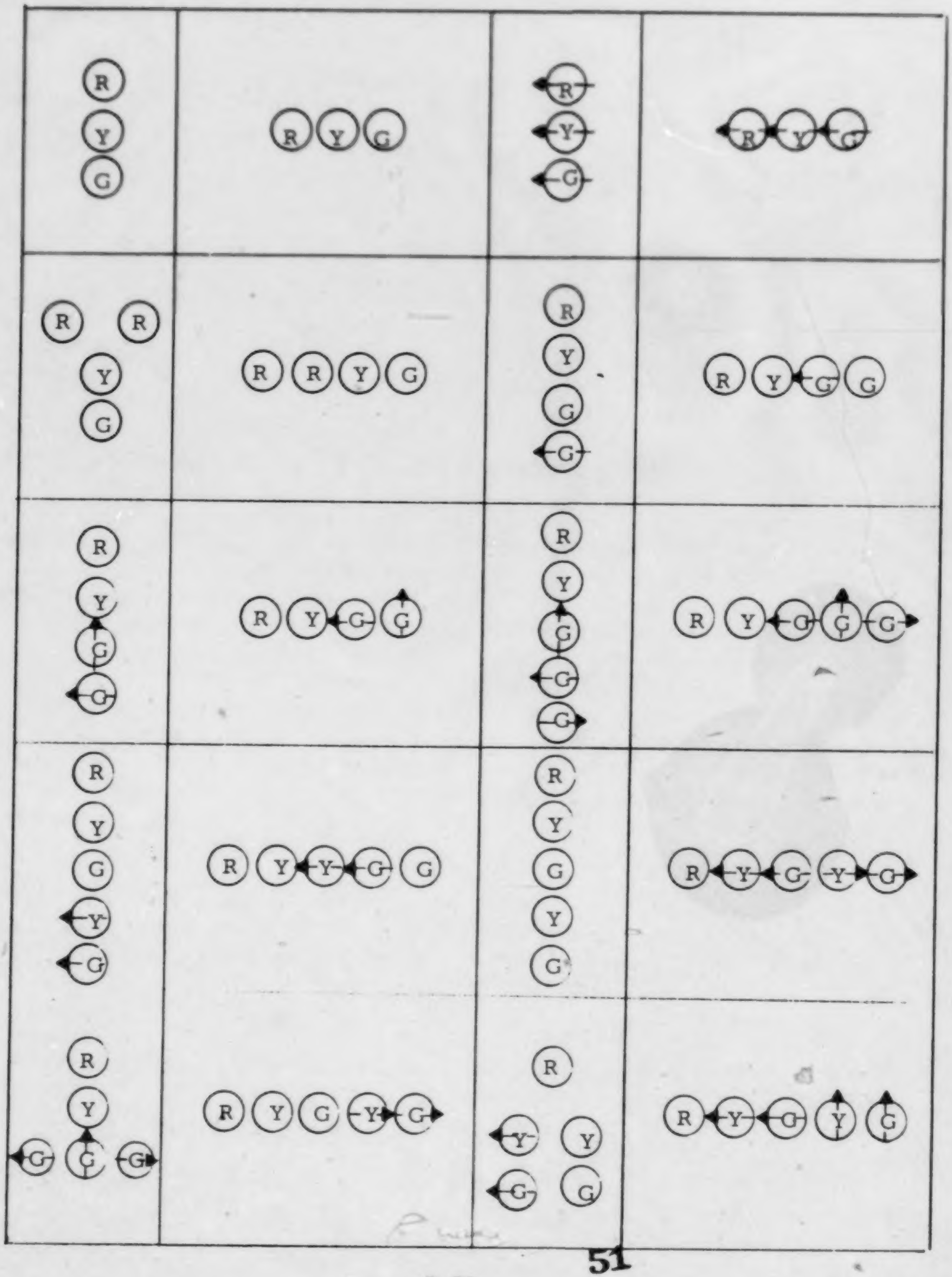
Traffic signal faces. The current standards specify that a minimum of two signal faces should be visible to traffic at a signalized intersection, supplemented by pedestrian signals where warranted. The purpose is to provide drivers with at least one signal indication if the view is obstructed by a larger vehicle, sunlight glare or other obstructions and increases driver safety if one lamp failure occurs. Typical arrangements of signals and lenses used jurisdictionally are shown in Exhibit 3-1.

Green indication. Vehicular traffic facing a circular green signal may proceed straight through or turn right or left unless a sign or arrow prohibits a turn. But vehicular traffic, including vehicles turning right or left, shall yield the right-of-way to other vehicles and to pedestrians lawfully within the intersection or an adjacent crosswalk at the time such signal is exhibited. Vehicular traffic facing a green arrow signal, shown alone or in combination with another indication, may cautiously enter the intersection only to make the movement indicated by such arrow, or such other movement as is permitted by other indications shown at the same time. Such vehicular traffic shall yield the right- of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection. Unless otherwise directed by a pedestrian signal, pedestrians facing any green signal, except when the sole green signal is a turn arrow, may proceed across the roadway within any marked or unmarked crosswalk.

Yellow indication. Vehicular traffic facing a steady circular yellow or yellow arrow signal is thereby warned that the related green movement is being terminated or that a red indication will be exhibited shortly thereafter when vehicular traffic shall not enter the intersection. Pedestrians facing a steady circular yellow or yellow arrow signal, unless otherwise directed by a pedestrian signal, are thereby advised that there is insufficient time to cross the roadway before a red indication is shown and no pedestrian shall then start to cross the roadway.

Exhibit 3-1

Typical arrangements of lenses in signal faces


R Y G
R Y G
R Y G
R Y G
R R Y G
R R Y G
R Y G G
R Y G G
R Y G G
R Y G G
R Y G G G
R Y G G G
R Y G Y G
R Y Y G G
R Y G Y G
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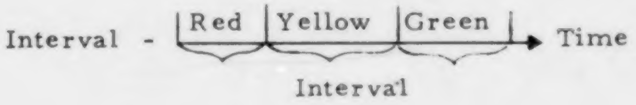
R Y G G G
R Y G Y G
R Y Y G G
R Y G Y G

Red indication. Vehicular traffic facing a steady circular red signal alone shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to proceed is shown. When a sign is in place permitting a turn, vehicular traffic facing a steady circular red signal may cautiously enter the intersection to make the turn indicated by such sign after stopping. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection. Unless otherwise directed by a pedestrian signal, pedestrians facing a steady circular red signal alone shall not enter the roadway.

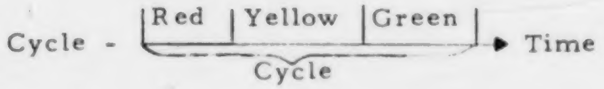
Vehicular traffic facing a steady red arrow indication may not enter the intersection to make the movement indicated by such arrow, and unless entering the intersection to make such other movement as is permitted by other indications shown at the same time, shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, of if none, then before entering the intersection and shall remain standing until an indication to make the movement indicated by such arrow is shown. Unless otherwise directed by a pedestrian signal, pedestrians facing a steady red arrow signal indication shall not enter the roadway.

There may be a requirement for a patrolman to initiate a traffic signal maintenance deficiency report and be able to discuss signal operations sequence. Therefore, he should have a basic understanding of the following operating terms: interval, cycle, and phase of operation.

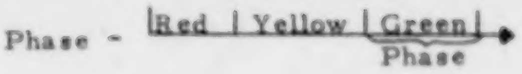
The interval is the time period during which the signal indication of any traffic signal face does not change, as illustrated below:



The cycle is the total time period of one complete sequence of intervals, as illustrated below:



The phase is the part of the total time cycle allocated to any traffic which has the right of way during one or more intervals as illustrated below.



Roadway Markings

Function of roadway markings. Roadway markings aid in regulating, guiding and channeling traffic into the proper position on the street or highways. They supplement other traffic control devices. The general principles of longitudinal markings are briefly described:

- *Yellow lines*. Separate traffic flow in opposing directions or mark the boundary of the travel path at locations of a particular hazard.
- *White lines*. Separate traffic in the same direction.
- *Red lines*. Indicate roadways that shall not be entered or used by the viewer of the lines.
- *Broken lines*. Imply permissiveness.
- *Solid lines.* Imply restrictiveness.
- *Width of line*. Indicates the degree of emphasis.

Types of longitudinal lines. The types of roadway markings are briefly reviewed below. Adaptation to standardized roadway marking is slowly being accomplished and in many instances conflicts exist. For example, many roads which should have yellow roadway markings are currently white.

- Broken white line (lane line)
- Broken yellow line (center line)
- Solid white line (lane line approaching an intersection)
- Solid yellow line (no passing marker)
- Double white line (channeling line)

- Double line consisting of normal broken yellow line and a normal solid yellow line (regulates passing)
- Double line consisting of two normal solid yellow lines (no passing marker)
- Double normal broken yellow line (reversible lanes)

Manual Traffic Direction and Control

Uniform and equipment requirements. Visibility is important, not only for the patrolman's safety but also for the safety of motorists and pedestrians. Patrolmen have been injured and even killed for the lack of reflective outerwear under conditions of poor visibility. The uniform and equipment requirements have to be brought by him to his assigned post and must be readily available.

For daytime operation, the normal police uniform should afford proper protection against the elements; this applies especially to patrolmen assigned to police vehicles. The improperly dressed officer presents a hazard to himself as well as to motorists. In the event of precipitation, the raincoat and cap cover should be readily available. For example, if assigned a regular traffic post, the patrolman can probably arrange to store his rain gear at a business establishment nearby.

The whistle, high visibility gloves, white or reflective cross belt or a reflective slipover vest are examples of wearing apparel/equipment which can aid the patrolman in conducting TDC. Normally, departmental policy will recommend what should be worn or used.

For nighttime operations or during periods of low visibility, the patrolman conducting TDC must have some highly reflective outerwear on for primarily two reasons: 1) effective TDC, and 2) personal, motorist and pedestrian safety. In addition to clothing and equipment mentioned previously, a flashlight or illuminated baton is required (use of the flashlight or illuminated baton is covered in Exhibit 3-2).

Exhibit 3-2

Signals and gestures*

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*Traffic Institute, Northwestern University. Signals and gestures. Traffic Direction Series. Evanston, Illinois: Author, 1960.

Exhibit 3-3

Directing vehicle movements*

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*Traffic Institute, Northwestern University. Directing vehicle movements. Traffic Direction Series. Evanston, Illinois: Author, 1961.

Section 4.0

TRAFFIC LAW ENFORCEMENT

SCIENCE AND TECHNOLOGY IN TRAFFIC LAW ENFORCEMENT

Introduction

As the traffic accident death rate has increased on our nation's highways, two of the frequent direct causes of accidents have been excessive speed and driving under the influence of alcohol and/or drugs. To relieve the burden placed upon the patrolman's "judgment" in detecting these offenses and to provide material evidence in court, various scientific instruments/devices have been developed to accurately measure vehicular speed and the presence and/or amount of alcohol and drugs in the body.

Speed Measurement

Early attempts. Serious attempts to measure vehicular speed accurately began in the early 1900s.

- Classic time distance. What is generally held to be the first attempt at precision speed measurement in the U.S. was implemented in New York City in 1903. On roads leading from the Bronx to Westchester County, three simulated tree trunks were positioned along the roadside at one-mile intervals. A patrolman with a stopwatch and telephone was hidden inside each tree trunk. When a suspected speeder passed the first station, the patrolman would indicate the moment of vehicle passage to the officer in the next tree, and this officer would start his stopwatch. When the car passed the second officer's post, he would stop his stopwatch and determine the vehicle's speed over the measured mile. If the speed was in excess of the posted limit, he would telephone the third officer and instruct him to apprehend the violator by lowering a pole across the road.

- Photo-Speed Recorder. Circa 1910, a device which consisted of a camera synchronized with a stopwatch was used. The camera took two pictures of a retiring vehicle at a controlled time interval. A mathematical calculation of vehicle speed was then possible based on: a) the difference in image size of the two successive pictures taken of the retiring vehicle, and b) the known time interval.

Current methods. Listed below are the major speed measurement methods in current use:

- Speedometer pacin[illegible]ocking. This is a widely used method by law enforcement agencies today. A patrolman in a patrol vehicle with a calibrated/accurate speedometer attempts to match the speed of the suspect vehicle, holding the inter-vehicle distance constant. The speed reading on the clocking car's speedometer is thus an accurate reflection of the suspect vehicle's speed.

- Speedwatch. This device is still used to some extent today and is alternately referred to as the "electric timer," or Prather Speed Device as it was originally called. A control panel containing a clock and a control switch is connected by an electric cable to two rubber tubes that are stretched across the width of the street. Rubber tubes are set 132 feet apart, with the distance being measured by a certified steel tape measure. Both tubes are located well to the left of the parked police car, enabling the tubes to be readily observed by the patrolman. When the patrolman detects a possible offender about to approach the first tube, he turns the switch to activate the first tube. When the approaching car strikes the first tube, a stopwatch is started. The switch is then returned to a neutral position to prevent interference from other vehicles striking the tubes. When the suspect vehicle is about to strike the second tube, the switch is turned to activate the second tube. When the car strikes the second tube, the clock is stopped, and the speed of the vehicle in miles per hour is read from a calibrated scale around the clock dial.

- Aerial speed measurement. Aircraft, both fixed wing and rotary wing, are being used to time the speed of motor vehicles on roadways. Readily observable road markings are painted at measured intervals (from 1/8 of a mile to one mile in length). Using a stopwatch, a police pilot can measure the time that it takes a suspect's vehicle to travel between two markers and readily determine the average speed of the vehicle. The identification, location, and direction of travel of any offending vehicle is radioed from the aircraft's pilot to a highway patrolman who can apprehend the offender.

- VASCAR. This is a relatively new computer-aided timing device that is coming into growing use. VASCAR stands for "visual average speed computer and recorder." The control unit basically consists of a "time" switch, a "distance" switch, and a display of computed speed. Both the control unit and the digital computer are mounted in the patrol car. While on mobile patrol, when the patrolman wishes to check the speed of a vehicle, he turns on the time switch when the suspect vehicle passes the first reference point on the roadway (any convenient reference like a roadside object, or change in pavement color). He turns off the time switch when the suspect vehicle passes a second reference point. The patrolman turns on the distance switch when his vehicle passes the first reference point and turns off the distance switch when his vehicle passes the second reference point. The average speed of the suspect vehicle is then calculated and automatically displayed.

VASCAR may be used when the patrol car is moving in the following situations:

- Patrol car following suspect car
- Suspect car following patrol car (in this case, the distance switch would be initiated first)
- Suspect car is approaching patrol car from the opposite direction

VASCAR can also be used in a stationary roadside position. In this case, the distance between two observable reference points would be entered into the computer, and the patrolman would only use the time switch to calculate the average speed of passing vehicles.

- Radar. The term, "RADAR", stands for "radio detection and ranging." In the classic military sense, this described a device that emitted electromagnetic radiation (radio waves) for the purpose of displaying a target's position (range and bearing) on an operator-controlled display (cathode ray tube). Use of radar by police for the detection of motor vehicle speed appeared in the late forties. The police radar unit is designed to emit a continuous stream or beam of radiation. When a moving vehicle strikes the beam, it causes an echo wave to return to the radar set. The difference in frequency between the wave emitted and the wave returned from the moving vehicle can be translated into a very accurate reading of "instantaneous" vehicle speed or velocity. The specific principle of operation for the police radar is called the "doppler-shift" principle which accounts for the frequency shift of radiation that is emitted or reflected from a body associated with its degree of movement. Police radar, as such, measures only the speed of a moving vehicle, not its relative position.

Certain radar countermeasure devices have been employed to either warn motorists of operating police radar or interfere with the operation of radar.

Small portable radar detection devices have been designed to emit a characteristic tone when exposed to the radar beam. These detectors are generally ineffective in urban and suburban areas because of interference from signals other than police radar. If the electro-magnetic signal environment is "quiet" (as in rural areas), these devices may detect the radar beam before a speed reading is obtained. However, in most cases, the average driver will not be able to reduce his speed significantly before a reading is obtained. Some states have made the operation of radar detection units by motorists illegal.

Portable, vehicle mounted, radar jamming devices have been developed to interfere with the operation of police radar in such a way as to cause an unstable or false speed reading. One type is a radio transmitter which produces either an off-scale or unstable reading. This type is illegal because it violates FCC licensing laws. The other major type is an audio transmitter. It emits a low frequency audio signal which returns the radar's echo wave at a higher frequency than would be received from only the moving vehicle. This causes an off-scale speed reading.

In conclusion, although there are devices available to detect or disrupt radar operation, there is not yet an effective, reliable, economical and legal instrument that will allow the average motorist to elude radar speed measurement.

Chemical Testing

Various techniques and devices have been developed through the years for the detection and quantification of alcohol in such bodily substances as breath, blood, urine, and saliva. The patrolman presently has little direct involvement in the sampling or testing of such bodily substances as blood, urine, or saliva. However, the patrolman will be more closely involved with the administration of breath tests for alcoholic influence.

History and development of breath analysis equipment. A device called the Drunkometer, developed in 1938, was the first practical portable breath analysis device. Many other devices have been developed and employed thereafter. The current trend is toward the development of automated breath analysis equipment. Lasar beam, infra-red, and electro-chemical/fuel cell principles are being investigated for application to breath analysis.

Types of breath analysis equipment. Breath equipment may be categorized into three basic types: screening devices, sampling devices, and testing devices.

- Screening device (qualitative). This is a portable or disposable device used in the field. It gives only an approximate indication of blood alcohol concentration (BAC) by the number and portions of bands of chromic gel crystals that are discolored on the inside of a glass tube. Bands typically represent .05% BAC or .10% BAC. Test results are usually not admissible in court. It can be a valuable device in the field in identifying a person with an unusually high or low BAC. In either case, the suspect may need prompt medical attention.

- Sampling device (quantitative). This is a portable device for obtaining a sample of breath or trapping the alcohol present in a sample of breath for subsequent quantitative analysis of BAC in the laboratory or by police personnel. It does not give an immediate quantitative determination of BAC. A screening test is usually a part of the sampling device.

- Testing device (quantitative). It gives an on-the-spot quantitative determination of BAC. Two types are in active or growing use by police personnel. Chromic acid/photoelectric devices collect a sample of breath which is bubbled through a solution containing a reagent or colored chemical substance that reacts with alcohol and, in doing so, loses an amount of original color. The color change of reagent is directly proportional to the amount of alcohol in the sample. The extent of color change is measured photoelectrically. A direct readout of BAC is provided.

  Gas chromatograph devices collect a sample of breath which is carried through a tubular column by a continuous flow of "carrier gas." Different substances on the breath move through the column at different rates and, therefore, arrive at the detector at different times. The detector transmits to a graphic recorder an amount of electrical current which is proportional to the concentration of each substance detected. The graphic recorder scribes a line, where the peak of the line indicates concentration, and time of appearance of the peak identifies the substance, in this case alcohol. BAC can be determined from graphic results, or obtained directly from a digital readout. The gas chromatograph can be valuable in identifying substances in the breath other than alcohol, clearly distinguishing them from alcohol. It can be used to analyze urine and blood for BAC, and the presence of certain drugs.

Chemical tests for drugs. Laboratory research results are presently lacking which would allow for the setting of presumptive levels of drug concentration related to generalized degrees of "impairment" in the population. Presently, law enforcement drug analysis is directed at a determination of the presence of or absence of certain drugs in bodily specimens, not the amount of any present. This is done by the laboratory analysis of urine or blood samples, with urine being the most popular as many drugs do not show up in blood samples. Drugs are not detectable in breath samples, unless they are volatile in nature.

TRAFFIC LAW ENFORCEMENT CONCEPTS AND BASIC PROCEDURES

Definition of Traffic Law Enforcement

Traffic Law Enforcement (TLE) may be broadly defined as the total law enforcement effort directed toward obtaining compliance with traffic regulations, when highway safety education and driver training efforts have failed to accomplish this end. Effective TLE is dependent upon the detection and apprehension of as many traffic law violators as possible, as well as the imposing of appropriate penalties upon those parties judged guilty of committing traffic offenses.

Objectives of TLE

Basically, the two primary objectives of TLE are to:

- Promote sustained compliance with traffic laws through deterrence
- Prevent hazardous traffic situations from occurring and thus prevent or reduce traffic accidents

Promote compliance through deterrence. Since traffic laws constrain behavior, there is a natural tendency, at times, for motor vehicle operators and pedestrians to ignore traffic regulations. Enforcement action by police personnel, besides stopping a continuing violation, tends to develop avoidance behavior (i.e., the avoidance of doing certain things for which punishment will be received) on the part of drivers and pedestrians.

The association of an unpleasant experience such as receiving a warning or summons or being arrested, with the act of committing a traffic violation can make the thought of committing a traffic violation sufficiently distasteful as to deter the would-be traffic violator. By creating a strong anticipatory avoidance reaction, sustained compliance through deterrence may be achieved. This compliance is achieved through a fear of such punishments as:

- Imprisonment and/or fine
- Loss of driving privilege
- Loss of prestige, embarrassment
- An accident and/or bodily harm

Eventually, the fear of punishment as a motivation for compliance with traffic violations may be replaced by the unconscious habit of compliance.

A vigorous and impartial program of TLE can instill certain beliefs that will foster an attitude of sustained compliance, such as:

- Equity and fairness of traffic laws
- Traffic laws are intended to insure safe and expeditious highway travel
- Omnipresence of law enforcement personnel (through patrol activity)
- Certainty of police action when offenses are committed
- Certainty of appropriate penalties being levied by the courts for traffic offenses. It is not the severity of punishment, but the certainty of punishment that is effective.

The TLE program can create motorist and pedestrian beliefs necessary for sustained traffic law compliance in the following ways:

- Direct effect. The fact that a violator is promptly apprehended and appropriately punished can have a direct effect on the development of his attitude of sustained compliance.
- Observational/symbolic effect. The fact that an individual may witness the apprehension of a traffic violator (or read/hear about the apprehension and punishment of a violator) serves as a reminder of the possible consequences of violating traffic laws. Thereafter, the observation of a patrol car or patrolman will symbolize the threat of enforcement action for a traffic violation. How long this symbolic effect persists after police contact is broken will depend upon:
    - Strength or effectiveness of the jurisdictional TLE program
    - Frequency of contact with representatives of the law enforcement agency
- Reputational effect. If, over a period of time, the TLE program attains a high degree of effectiveness, a community-wide general belief or reputation may be fostered (through word of mouth, publicity) that the commission of traffic violation is a risky action. This belief should not be

dependent upon observation of law enforcement personnel. It is this reputational effect of discouraging traffic violations and obtaining sustained compliance that law enforcement agencies strive to achieve.

Prevent occurrence of hazardous traffic situations. Since traffic laws and regulations have been developed to promote the safe and expeditious flow of traffic, TLE and resultant compliance with traffic laws will prevent the following types of hazardous situations from occurring:

- Unsafe condition. This refers to an unlawful/unsafe condition of the vehicle, driver, or roadway. Examples of unsafe vehicle conditions would be defective brakes or tail lamps. Examples of unsafe driver conditions would be "under the influence of alcohol or drugs." Examples of unsafe roadway conditions would be obscured or damaged traffic control devices through malicious action.

- Unsafe behavior. The actual performance of the driver as reflected in the control of his vehicle, as well as the performance of the pedestrian, may be hazardous and unlawful. Examples of unsafe driver behavior would be exceeding the posted speed limit and disregarding a stop sign. Unsafe pedestrian behavior could be the disregarding of a traffic control device/patrolman or crossing between intersections.

Traffic Offenses

Definition. A traffic offense/violation is a designation phrase given for the group of elements which constitute a violation of a particular section of the traffic laws or vehicle code.

Elements of a traffic offense. The elements of a traffic offense are the observable conditions or behaviors that must be present or have occurred in order for a traffic offense to have been committed. The elements of each offense are found in the traffic laws and the patrolman must account for all the elements of a traffic offense before the violation can be charged. This is necessary since the elements of a traffic offense must be proved by the prosecution in court.

It is essential that the patrolman have a clear working understanding of the jurisdictional traffic laws (the classes of offenses and their elements) as well as the departmental enforcement policy to be effective in the field in detecting traffic offenses.

Varieties of offenses. The major varieties of offenses fall into the following categories:

- "Shall do". Applies to those offenses characterized by a person's failure to perform required acts under the conditions specified by the traffic law.
- "Shall not do". Applies to offenses characterized by the commission of an act that is prohibited by traffic law.
- Momentary versus continuous. Momentary offenses are those related to illegal behavior or acts committed that last for a relatively short period of time (e.g., running a stop sign). Continuous offenses specifically relate to continuing or persistent illegal conditions (e.g., driving under the influence of alcohol).

Major groups of traffic offenses. There are two major groups of traffic offenses/violations: "hazardous," and "other."

- Hazardous offenses. This category refers to violations of traffic laws that concern the use or protection of streets and highways--laws enacted to regulate the safe movement of vehicles and pedestrians. The majority of hazardous violations are "moving" violations or unsafe behavior concerned with such traffic factors as speed, right of way, observance of signs, signals, and markings, turning movements, following and overtaking, pulling away, and unsafe pedestrian behavior. Unsafe conditions are also included, such as defective vehicular equipment or driving under the influence of alcohol or drugs. Hazardous traffic violations that are frequently associated with traffic accidents are following too closely, failure to yield right of way, speed too fast for conditions, driving under the influence of alcohol or drugs, and inadequate brakes.
- "Other" offenses. This category refers largely to illegal, unsafe conditions such as missing or defective motor vehicle equipment.

Functions of the Traffic Law Enforcement System

The TLE system consists of three major subsystems, namely, the law enforcement/police agency, the traffic court, and the driver licensing agency.

Law enforcement agency. The basic TLE functions of the law enforcement agency are:

- Surveillance/patrol
- Detection (of offenses)
- Apprehension and charging

Traffic court. The major functions of the judicial system are:

- Prosecution
- Adjudication
- Penalization

Driver licensing agency. The major enforcement functions of this agency are:

- Traffic violation record keeping (e.g., the point system)
- Driver license suspension
- Driver license revocation

Traffic Law Enforcement and Accident Reduction

Enforcement index (EI). The EI is a statistic that reflects the effectiveness of the TLE program in reducing accidents and is expressed in the following manner:

$$\text{EI} = \frac{\text{Number of convictions with penalties for hazardous offenses}}{\text{Number of fatal and personal injury accidents}}$$

The number of convictions with penalties and the number of fatal and personal injury accidents that are used for the calculation of the EI must have occurred within the same time period.

The ideal EI for a jurisdiction is attained when an increase in enforcement actions will not reduce the accident rate, while less effort will permit continued increase in accidents. Although the most effective EI for a jurisdiction must be individually determined, generally an EI of 20 is satisfactory. This means that there are 20 convictions for hazardous violations for each accountable serious accident. There would theoretically be a higher actual enforcement rate than 20:1, for charges that are dismissed or continued and drivers that fail to appear in court should be considered.

It may be necessary to achieve an EI of 30 or more in some jurisdictions before the frequency of accidents begins to show a substantial decline. The effectiveness of the EI must be reassessed periodically. It is important to understand that the EI is based upon the fact that as the conviction rate for hazardous offenses increases, the accident rate will decrease.

Selective enforcement. "Selective enforcement" is defined as traffic law enforcement efforts directed toward the time and place of high traffic accident frequency, with particular concern for enforcing violations that contribute to accidents. When focusing patrol and stationary observation efforts in critical areas of accident experience, emphasis is given to deterring and/or detecting violations commonly associated with accidents in that area. Selective enforcement is an efficiency of operation necessitated by the fact of life that law enforcement agencies do not have the manpower to enforce all traffic laws, at all times, in all places.

Traffic Surveillance

Traffic patrol. Traffic patrol is considered to be that part of a patrolman's activity where he moves about (driving or walking) within a designated geographical area or given roadway for the general purpose of traffic surveillance. The basic objectives of traffic patrol are to:

- Deter would-be traffic violators (symbolic effect of the patrolman's presence)
- Detect and apprehend traffic law violators, as well as criminal offenders
- Report traffic problems, handle emergencies, and ensure the smooth flow of traffic
- Report road conditions which need attention
- Render aid and assistance to motorists where necessary

The basic types of traffic patrol that a law enforcement agency may conduct are:

- Area patrol--patrol in an area or beat which may include several streets, roads, or sections of a highway
- Line patrol--patrol on a designated route between two points, usually on a city street or a section of a highway

Stationary traffic observation. In addition to the various forms of patrol, stationary observation constitutes another form of traffic suveillance. It is observation by a patrolman at a selected place (highway patrolman in a patrol car, or foot patrolman on a "traffic post"), usually a location that experiences a high accident rate or chronic traffic problem, for the purpose of deterring and detecting traffic violations. This procedure includes the monitoring of the speed of passing vehicles with speed measuring devices such as radar, VASCAR, etc.

Ways to conduct traffic surveillance. There are three basic approaches to the conduct of traffic surveillance.

- Conspicuous surveillance. The patrolman endeavors to attract attention by remaining in full view of traffic with a conspicuously marked patrol vehicle.

- Visible surveillance. The patrolman is located in full view of traffic, but in such a manner as to require some scrutiny by a person to be discovered (e.g., unmarked or unapparently marked patrol vehicle, vehicle parked inconspicuously on a side street).

- Concealed surveillance. The patrolman is not visible to persons on the roadway during the course of their normal observation of the roadway scene (e.g., radar speed trap - "off the street").

Traffic screening. A method for detecting unsafe driver and vehicular conditions is the traffic road check. Traffic road checks involve the stopping of vehicles (often a sampling of passing traffic in a roadway) at a designated position on the roadway by patrolmen for the purpose of inspecting drivers and/or vehicles and detecting any traffic law violations. Police are typically empowered by state statute to check the validity of operator's license, and vehicle registration, as well as the state of repair of the vehicle. The specific functions of traffic road checks are to:

. Detect unsafe/faulty equipment

. Detect a license or registration violation, including such conditions as:

  - Expired date of effectiveness

  - Forged, or substituted document

- Suspended or revoked license
- License restriction violation

- Detect cargo violation of commercial vehicles (weight, size, storage, etc.)
- Detect tax law violations of state lines
- Detect motor vehicle operator driving under the influence of alcohol or drugs. (This should not be an explicit objective, but is incidental to the above functions.)

Traffic Law Enforcement Actions

The possible actions that a patrolman may take in response to a traffic law violation are three; a traffic warning, a traffic citation or summons, or a traffic arrest. Which course of action is taken by a patrolman depends upon the severity of the offense, and the enforcement policy established by the Commissioner or Chief.

Traffic warning. A traffic warning is any traffic enforcement action taken which does not immediately involve possible assessment of legal penalty as a result of the warning alone. Some of the forms of traffic warnings that may be issued are:

- Written traffic warning. This is a warning where the violator is given an oral account and a documentary record of the violation after detection of the infraction. The violator may be required to acknowledge receipt of the warning with his signature. A written warning may be recorded or unrecorded. A recorded written warning is one where the record of issuance is left on file by a state agency (law enforcement, DMV, etc.) for future reference. An unrecorded written warning is one where no record of issuance, formal or informal, is kept.
- Oral and visual traffic warnings. Warnings may be primarily of an oral/verbal or visual/gesture nature or a combination thereof. In either case, no written record, formal or informal is kept.

Warnings differ qualitatively from citations and traffic arrests in that the enforcement consequences are concluded when the patrolman leaves the scene. The warning itself is the penalty. Warnings have more of an educational effect than a disciplinary effect.

Traffic citation (summons, ticket, notice to appear). A traffic citation is traffic enforcement action consisting of the issuance of a written "uniform traffic summons/complaint" or citation, requiring a person charged with a traffic violation to submit to trial adjudication to determine his guilt or innocence, or in some cases, to pay a fine in lieu of court appearance. A traffic citation is the most frequently used means by which the traffic violator may be brought before the court, without taking the violator into physical custody. Since citations often involve the inconvenience and distress of a court experience, and usually a fine, they are a more extreme form of law enforcement action than a traffic warning.

Traffic arrest. A traffic arrest is an action whereby a violator is taken into physical custody for the purpose of detaining him until such time as he can be brought before the court to answer the charge of law violation. A traffic arrest is the most extreme form of traffic law enforcement action. In some cases, the suspect may leave custody after posting bail. The primary objectives of a traffic arrest are to:

- Preclude the possibility of a continued violation (such as driving under the influence of alcohol or drugs) and a continuing hazardous traffic situation.

- Increase the chances that the violator will appear in court, where doubt may exist

Basic Features of a Traffic Violator

A "traffic violator" may be either a motor vehicle operator or a pedestrian. This section of the Study Guide will explore some of the factors that may affect the behavior of a driver or pedestrian violator.

The senses. These include the human capabilities to detect information in the enviornment--such capabilities as vision, hearing, taste, smell, bodily feelings (e.g., touch; pressure; sensation of bodily movement--forward, backward, up/down, sideways; position of limbs). The senses of particular importance to traffic performance are the visual, auditory, and "feeling" senses. It is clear that if the functioning of the critical driving senses are impaired (by use of alcohol or drugs, advancing age, injury or illness, etc.), performance in traffic situations will suffer. "Perception" is the process of giving meaning to the things we sense.

Knowledge. An individual's awareness and understanding of the factors affecting safe traffic performance is critical to his performance. An individual's knowledge of the following factors is of particular importance to the driving situation:

- Traffic laws
- Operational aspects (cause and effect) of physical laws governing the traffic situation
- His own physical capabilities and limitations

Physical or motor skill. This is the ability to control bodily movement in a smooth and coordinated manner. Individuals differ in terms of their inherent capacity to acquire motor skills. Motor actions are often performed in response to external events or stimuli and therefore are associated with the process of perception--and thus the term perceptual/motor skills is often used in this regard. In traffic situations a critical factor involved in driver/pedestrian performance is "reaction time." Reaction time is practically defined as the time between the onset of a stimulus and the completion of the appropriate response to that stimulus (e.g., the time from when a traffic light turns "amber" to when a driver puts his foot on the brake). Reaction time varies between individuals, is generally faster to strong stimuli than weak stimuli, and increases with advancing age.

Habits. These are the consistent and automatic reactions of people to reoccurring situations. "Good" traffic habits will facilitate traffic performance; for "bad" traffic habits, the converse will be true.

Attitude. This is a state of mind or tendency to respond in a certain way in given situations. People have many attitudes about many different subjects (e.g., race, religion, rights of others, etc.), and they may be broadly classed as positive, negative, or neutral. An individual's attitude toward authority, rules and regulations, the rights of others and himself are of particular importance in the traffic situation.

Judgment/decision making. One's capacity for sizing up a situation and determining an appropriate course of action has a critical influence on human performance. The development of this faculty is highly dependent upon acquired knowledge and past experience.

Attention/awareness. This is basically the ability of the individual to focus or direct his powers of concentration or thought to an idea or task being performed. Apparently man can direct his attention to one thing at a time, but does have the capacity to rapidly shift his attention among several things. If one is preoccupied or distracted with feelings of strong emotion (anxiety/worry, rage, etc.), his attention will be diverted from the traffic situation and his traffic performance will suffer.

Motives and emotions. Motives are considered the reasons, purposes, conditions, or states that initiate and control behavior. Some motives are built in such as hunger, thirst, sex, etc. Many motives are primarily learned through experience such as fear, need for love, need for power or prestige, etc. Strong emotional states (subjective feelings) such as fear, anger, elation can motivate people. The relative strengths and effects of learned motives/emotional states are constantly changing for a given individual--hour to hour, day to day, week to week, etc.

Why People Violate the Law

Most people do not willingly create hazardous traffic situations associated with the violation of a traffic law. Very often people do not understand the fact that traffic laws and regulations were enacted to ensure the safe and efficient passage of traffic. People do not always perceive the risks inherent in a particular traffic situation and commit a traffic violation for some of the following reasons:

- Their senses and reactions may be impaired for a variety of reasons (e.g., emotionally disturbed, ill, fatigue, under the influence of alcohol or drugs)
- They are ignorant of the basic effects of physical laws or the detailed operational aspects of traffic laws that are operant in the traffic situation
- They may overestimate (or underestimate) their capabilities
- Some people disrespect traffic laws and willfully disregard them.

CHARACTERISTICS OF THE PHYSICALLY IMPAIRED VIOLATOR

There are many varieties of physical conditions that can cause a person to violate a traffic law, some of which to be discussed are "under the influence of alcohol and drugs," fatigue, illness and injury, and ageing.

Under the Influence of Alcohol

As stated in the 1968 Alcohol and Highway Safety Report by the U. S. Department of Transportation, the use of alcohol has led to some 25,000 deaths, a total of at least 800,000 traffic accidents annually--the statistics do indicate clearly that alcohol is a factor present to some degree in about 50% of all accidents. The detection and apprehension of the drinking driver is a high priority objective for TLE.

Properties of alcohol. By alcohol is meant the substance called "ethyl alcohol" or "ethanol", which is the primary constituent of alcoholic beverages. As a pure chemical, it is clear, colorless, and practically odorless. It has a burning sensation in the mouth and mixes freely with water. It is generally harmless when consumed in moderate quantities, but when consumed in sufficiently large quantities, it can be lethal. Its effect on the body is that of a depressant and anesthetic, not a stimulant.

It is produced by the fermentation of such organic substances as fruit, fruit juices, malt, cereal grain extract, vegetable pulp, molasses, etc. The maximum natural alcoholic content of fermented beverages is 14-15% by volume (e. g., beer, ale, porter, wines). Distilled beverages such as whiskey, vodka, gin, and rum are produced by heating fermented alcohol mixtures. Since alcohol boils at a lower temperature than water, the alcohol can be boiled off or distilled, increasing the alcoholic content of the finished beverage.

- Congeners. In addition to alcohol and water, alcoholic beverages contain numerous compounds or impurities known as "congeners." Congeners typically impart a characteristic flavor and odor to the beverage and give rise to what people call "the smell of alcohol or beer" on a person's breath. Congeners constitute a very small proportion of the total volume of an alcoholic beverage. There is no evidence that congeners contribute to the depressant effect of alcoholic beverages.

- Proof system. The proof number of a beverage represents twice the percent of alcohol by volume (e.g., 100 proof beverage contains 50% alcohol by volume). Most alcoholic beverages have a maximum of approximately 50% alcohol by volume or 100 proof. The remainder is water and congeners. For example, beer has a relatively low alcoholic content and is approximately 90% water.

Alcohol in the body. For chemical testing purposes, the amount of alcohol in the blood is termed blood alcohol concentration or BAC. BAC is expressed in weight of alcohol per volume(w/v) of blood--typically, the weight of alcohol in grams per 100 cubic centimeters or milliliters of blood. Thus, a BAC of .05% w/v is equal to 50 mg. of alcohol per 100 ml. of blood. BAC's are fractions of 1% concentration. In breath testing, the patrolman may encounter the term BAQ, which stands for "breath alcohol equivalent." The term represents the alcoholic concentration as measured from a breath sample. Numerically, the terms BAC and BAQ are identical. Thus when a person with a BAC of 0.10% is given a breath test, a reading of 0.10 BAQ should be obtained.

- Alcohol absorption route. Alcohol can be absorbed through the mouth lining. Such absorption is normally insignificant since the fluid typically leaves the mouth rapidly. The presence of alcohol persists in the mouth after the alcohol has left the mouth. However, the mouth of a person will be free of alcohol after about 20 minutes since alcohol was last present in the mouth.

  About 25% of the alcohol is absorbed directly into the blood stream unchanged through the stomach wall. The exact amount is variable and influenced by the emptying time of the stomach. No other substances (even liquids) are absorbed from the stomach. The remainder of alcohol is absorbed from the small intestine. Very little alcohol gets past the first 8 to 10 inches of the small intestine.

- Alcohol absorption rates. The rate of absorption varies somewhat from person to person and for the same person at different times. Alcohol passes into the bloodstream within 1 or 2 minutes after consumption. Most alcohol is absorbed within 15 minutes and nearly 90% within 1 hour. Most alcohol is absorbed within 1-1/2 hours, however in some cases almost three hours may be required for total absorption. Absorption through the stomach wall is slow and represents only a small portion of the total intake. Absorption through the small intestine is rapid. Food in the stomach delays absorption by holding the alcohol in the stomach longer. This applies to eating both before and during the intake of alcohol.

- Distribution of alcohol. Alcohol is absorbed into the blood stream unchanged through the walls of the stomach and small intestine. It travels via the portal vein to the liver. Thereafter, it travels via the circulatory system to the heart, lungs and back to the heart, and is then pumped to all parts of the body. Organs such as the brain, liver, and kidney, which have a large blood supply initially receive a considerable amount of the circulating blood containing alcohol. When absorption and distribution are complete, alcohol is distributed in areas of the body proportional with their fluid/water content.

- Elimination of alcohol. Alcohol is eliminated from the body by a biochemical reaction and direct excretion. Between 90% and 98% of alcohol in the body is burned up or oxidized to carbon dioxide and water in the liver. A small amount (2%-8%) of alcohol is excreted, unchanged, through the breath, urine, tears, saliva, and perspiration.

- Rate of elimination. The average rate of elimination is reported at being between 0.015% and 0.018% per hour. At low BAC's, the average rate is about 0.01% per hour. For a man weighing 150 pounds, the quantity eliminated in one hour is about 2/3 oz. of 100 proof whiskey. The rate of elimination is not significantly affected by stimulants (drugs, coffee), or exercise (i.e., increased breathing rate, physical exercise). It should be noted that the rates of elimination previously quoted are only average and should be used with caution as a means of estimating a person's BAC at some time prior to a chemical test.

- Concentration of alcohol in the body. In Exhibit 4-1, a table of average BAC's achieved for given numbers of drinks versus body weight is presented. In general, a heavier person can consume more of an alcoholic beverage than a lighter person to achieve the same BAC. There is approximately the same amount of alcohol in a

Exhibit 4-1

Blood alcohol chart of body weight vs. drinks consumed

Showing estimated percent of alcohol in the blood by number of drinks in relation to body weight. This percent can be estimated by:

1. Count your drinks (1 drink equals 1 ounce of 100-proof liquor or one 12-ounce bottle of beer).
2. Use the chart below and under number of "drinks" and opposite "body weight" find the percent of blood alcohol listed.
3. Subtract from this number the percent of alcohol "burned up" during the time elapsed since your first drink. This figure is .015% per hour.

Example: 180 lb. man - 8 drinks in 4 hours

.167% minus (.015 x 4) = .10%

	DRINKS											
Body Weight	1	2	3	4	5	6	7	8	9	10	11	12
100 lb.	.038	.075	.113	.150	.188	.225	.263	.300	.338	.375	.413	.450
110 lb.	.034	.066	.103	.137	.172	.207	.241	.275	.309	.344	.379	.412
120 lb.	.031	.063	.094	.125	.156	.188	.219	.250	.281	.313	.344	.375
130 lb.	.029	.058	.087	.116	.145	.174	.203	.232	.261	.290	.320	.348
140 lb.	.027	.054	.080	.107	.134	.161	.188	.214	.241	.268	.295	.321
150 lb.	.025	.050	.075	.100	.125	.151	.176	.201	.226	.251	.276	.301
160 lb.	.023	.047	.070	.094	.117	.141	.164	.188	.211	.234	.258	.281
170 lb.	.022	.045	.066	.088	.110	.132	.155	.178	.200	.221	.244	.265
180 lb.	.021	.042	.063	.083	.104	.125	.146	.167	.188	.208	.229	.250
190 lb.	.020	.040	.059	.079	.099	.119	.138	.158	.179	.198	.217	.237
200 lb.	.019	.038	.056	.075	.094	.113	.131	.150	.169	.188	.206	.225
210 lb.	.018	.036	.053	.071	.090	.107	.125	.143	.161	.179	.197	.215
220 lb.	.017	.034	.051	.068	.085	.102	.119	.136	.153	.170	.188	.205
230 lb.	.016	.032	.049	.065	.081	.098	.115	.130	.147	.163	.180	.196
240 lb.	.016	.031	.047	.063	.078	.094	.109	.125	.141	.156	.172	.188

For clarification, if the 180 lb. person had all the alcohol from 12 ounces of 100 proof whiskey or 12 twelve-ounce bottles of beer in his body at one time, he would have a blood alcohol reading of 0.25% blood alcohol by weight.

12 ounce bottle of beer as there is in one ounce of a 100 proof liquor.

To estimate a person's BAC, knowing the number of bottles of beer consumed or ounces of 100 proof beverage, an elimination factor of 0.015% is subtracted for each elapsed hour since drinking began. Food in the stomach will delay absorption and result in a lower BAC than would be obtained if the stomach were empty--food will also result in a more prolonged BAC at a given level. When several drinks are consumed in a very short period of time, peak BAC's may not appear until 45 minutes to 1-1/4 hours after the last drink.

Effects of alcohol on behavior. Alcohol is a depressant, and not a stimulant. Many people think it is a stimulant because its first noticeable effect is to reduce inhibitions and promote a feeling of well being. The first step of impairment is on the most recently developed part of the brain--the part that controls a person's judgment and morals, and powers of attention. As a result, one's self-confidence increases. If alcohol is drunk in sufficient quantities the functioning of the oldest part of the brain that automatically controls a person's body functions can be impaired such that a person can lose complete control of himself, pass into a coma, and ultimately die if the respiratory center of the brain is depressed. Between the mild effects and severe effects of alcohol there is a progression of deterioration in performance:

- Speech becomes slurred
- Vision is impaired
    - Pupils of the eye generally enlarge and reaction to visual stimuli becomes slower; bright lights and glare are bothersome
    - Distance judgment is impaired as well as the ability to see things to one side or the other of the visual field (side vision or peripheral vision)
    - Ability to focus from far to near objects increases at a BAC of 0.06%
    - At BAC's of 0.10% blurred vision results

- Reaction time increases and physical coordination is impaired:
  - The beginning of impairment of physical coordination can be with a BAC as low as 0.02%
  - Motor tasks which require complex discrimination are impaired at BAC's of 0.05%
- Sensitivity to most stimuli (visual, auditory, pain) generally decreases

- Stages of intoxication. The stages of alcoholic influence are shown in Exhibit 4-2. There are no precise BAC's that define the various stages--there is overlap. The BAC ranges in Exhibit 4-2 indicate that not all people are equally affected at the same BAC value.

- Effects on specific areas of the body. There is no evidence that alcohol significantly improves circulation. Following absorption, blood alcohol enlarges the vessels of the skin and permits an increase in skin blood flow. This accounts for the flushed face of the drinker. Alcohol stimulates the kidney to produce urine. Moderate use of alcohol does not appear to cause any kidney damage. Heavy use of alcohol causes an accumulation of fat in the liver, a condition referred to as fatty liver. This may result in an inflammation of the liver, commonly called cirrhosis. However, cirrhosis appears to be more a result of the poor diet of the alcoholic, rather than a direct result of alcohol. Moderate use of alcohol does not appear to have a harmful effect on the liver of healthy, well-nourished people.

- Common symptoms of alcoholic influence. Some of the typical symptoms of alcoholic influence that the patrolman may have occasion to observe are listed below:
  - Odor of alcoholic beverage on the breath
  - Swaying or unsteadiness--staggering
  - Poor muscular coordination
  - Confusion, lack of response to stimulation

Exhibit 4-2

Stages of acute alcoholic influence/intoxication*

ETHYL ALCOHOL LEVEL, Per cent by Weight Blood (Urine)	STAGE OF ALCOHOLIC INFLUENCE	CLINICAL SIGNS/SYMPTOMS
0.01-0.05 (0.01-0.07)	Sobriety	No apparent influence Behavior nearly normal by ordinary observation Slight changes detectable by special tests
0.03-0.12 (0.04-0.16)	Euphoria	Mild euphoria, sociability, talkativeness Increased self-confidence; decreased inhibitions Diminution of attention, judgment, and control Loss of efficiency in finer performance tests
0.09-0.25 (0.12-0.34)	Excitement	Emotional instability; decreased inhibitions Loss of critical judgment Impairment of memory and comprehension Decreased sensitory response; increased reaction time Some muscular incoordination
0.18-0.30 (0.24-0.41)	Confusion	Disorientation, mental confusion; dizziness Exaggerated emotional states (fear, anger, grief, etc.) Disturbance of sensation (diplopia, etc.) and of perception of color, form, motion, dimensions Decreased pain sense Impaired balance; muscular incoordination; staggering gait, slurred speech
0.27-0.40 (0.37-0.54)	Stupor	Apathy; general inertia, approaching paralysis Markedly decreased response to stimuli Marked muscular incoordination; inability to stand or walk Vomiting; incontinence of urine and feces Impaired consciousness; sleep or stupor
0.35-0.50 (0.47-0.67)	Coma	Complete unconsciousness; coma; anesthesia Depressed or abolished reflexes Subnormal temperature Incontinence of urine and feces Embarrassment of circulation and respiration Possible death
0.45 + (0.60 +)	Death	Death from respiratory paralysis

* Prepared by: Kurt M. Dubowski, Ph.D., FAIC, Director, Department of Clinical Chemistry and Toxicology, University of Oklahoma, School of Medicine, Oklahoma City, Oklahoma, Member, Committee on Alcohol and Drugs, National Safety Council.

- Sleepiness
- Disorderly appearance
- Speech impairment, such as slurred, confused, thick tongue
- Dizziness
- Nausea
- Unusual actions, such as being very talkative, aggressive, depressed, jovial
- Visual disorders--fixed stare--bloodshot/watery/glassy eyes
- Flushed face

- Other conditions that can be confused with alcoholic influence. The trainee should be aware that many so-called "alcoholic influence" symptoms could be associated with such illnesses and injuries as a concussion, heart attack, epilepsy, diabetic coma as well as certain forms of drug abuse. The patrolman should examine and question the suspect carefully in order that his possible need for medical attention will not be overlooked. A chemical test for alcoholic influence can thus serve to protect the public by providing an alert to the suspect's need for medical attention. For instance, a low BAC may indicate that the suspect's abnormal behavior is due to a serious condition other than alcoholic influence such as diabetic coma. A very high BAC indicates the need for medical assistance to minimize the possibility of respiratory or cardiac arrest.

- Tolerance to alcohol. It is well known that people react differently to alcohol, that is, some are better able to "hold their liquor" than others. Different individuals at the same BAC level react differently. Although it may be said that the heavy drinker has learned to compensate for the effects of liquor (e. g., by standing with his feet farther apart to minimize swaying), tolerance has been noted in the person with no previous exposure. It is the opinion of most investigators that tolerance is limited and occurs most frequently at BAC's of 0.10% or less. Individuals with the same weight attain different BAC's from the same amount of alcohol. The exact reasons for differences in tolerance to alcohol are unknown but the following reasons have been proposed:

- Delayed absorption
- Decreased penetration in the central nervous system
- Increased elimination
- Increased water content of the body
- Increased tissue tolerance

Effects of alcohol on driving behavior. As an increasing BAC will impair the performance of the individual so will it affect his driving performance and behavior in traffic. Some of the commonly observed forms of driving behavior associated with alcoholic influence are listed below:

- Inefficient behavior
  - Extremely slow or erratic speeds on open highways
  - Making stops where none are required
    - Long stops at stop signs
  - Apparent confusion at signalized intersections
  - Open car windows--especially in cold weather
- Poor control
  - Failure to dim lights for passing traffic
  - Vehicle over center line--especially when making turns or approaching other vehicles
  - Erratic movement such as weaving, driving on the shoulder, stopping and starting, abrupt turns without signaling, swerving when passing another vehicle
- Parking in unusual places such as the roadway itself
- Repeated moving violations such as failure to observe signals, signs, and markings, failure to grant right-of-way, excessive speed, etc.

Under the Influence of Drugs (and Chemicals)

Although alcohol is technically considered a "drug," the term drug is generally reserved for other substances which will be reviewed. Some of these drugs may have little or no medicinal value; others have medicinal value and are produced legitimately but sold illegitimately for illegitimate use or abuse. Finally, there are prescription drugs that may be misused by the legitimate user--a doctor's patient.

Major groups of drugs. The characteristics of major groups of drugs are reviewed below. When abused, these drugs can impair a person's performance in traffic:

- Narcotics/opiates. Includes such drugs as:
  - Opium
  - Opium derivatives such as morphine, codeine, and heroin
  - Synthetic opiates such as methadone

  These are drugs which produce insensibility or stupor because of their depressant effect on the nervous system and are used medically for the control of extreme pain. Symptoms of the influence of these drugs are:

  - Insensitivity to pain
  - Heightened sense of well being or euphoria
  - Deep lethargy
  - Intoxication and ultimately sleep

  Since the continued use of these drugs can produce physical dependance or addiction, when such use of these drugs is stopped, powerful "withdrawal" symptoms such as the following can be produced:

  - Nervousness, anxiety

  - Dilated pupils (heightened sensitivity to light)

  - Muscular pain

  - Vomiting and diarrhea

  - Desperate and compulsive behavior to obtain the drug

- Stimulants. Includes such drugs as:

  - Amphetamines (Dexedrine,® Benzedrine®)
  - Methamphetamine ("speed")
  - Cocaine

  Some of these drugs are widely prescribed for the treatment of obesity and mild depression. They directly affect the central nervous system and produce the following effects:

  - Excitation, mental arousal, heightened states of physical activity, talkativeness, hand tremor, and perspiration

  - Rise in blood pressure and respiratory rate

  - Heightened sense of potence and self-confidence

- Depressants (Sedatives - Hypnotics). Barbituates receive the greatest abuse of this group, some examples of which are:

  - Phenobarbital
  - Secobarbital
  - Amobarbital

  Barbituates have a strong calming effect and are prescribed as treatment for high anxiety states and high blood pressure. Abuse of these drugs can produce the following symptoms:

  - Slurred speech
  - Loss of balance, staggering and falling
  - Quickness of temper, quarrelsome disposition

- Hallucinogens. These drugs have little or no medical benefit and are generally produced and distributed through illicit channels, with examples being:

  - LSD (Lysergic Acid Diethylamide - "acid")
  - Mescaline
  - Marihuana
  - DMT

Hallucinogens produce distortions of perception, bizarre dream images, and hallucinations. When abused, they can produce such effects as:

- Impaired ability to discriminate between fantasy and reality
- Impaired judgment of direction and distance
- Dilated pupils
- Restlessness and insomnia
- LSD use can result in:
  - Perspiration
  - Violent movement, panic, and even attempts at self-destruction

- Tranquilizers. This category refers to a large group of prescription drugs that when taken as prescribed have calming properties without loss of alertness or performance, e.g.:

  - Phenothiagine
  - Reserpine
  - Meprobamate (Miltown®)

  When taken in excessive amounts, these drugs can produce dizziness and drowsiness.

- Antihistamines. Drugs of this group are widely prescribed to control the symptoms of allergies (sinus, nasal congestion, etc.). They have sedative properties which result in the following effects on performance:

  - Inattention
  - Confusion
  - Drowsiness

- Anti-infective drugs. Occasionally, such anti-infective drugs as the antibiotic and sulfa drugs can impair performance. These drugs can produce such symptoms as:

- Dizziness
- Drowsiness
- Nausea/vomiting
- Mild euphoria

- Volatile substances (chemicals). Non-drug or chemical substances may be abused, such as:

  - Certain glues
  - Gasoline
  - Lighter fluid

  The fumes of these volatile and toxic substances are sometimes inhaled producing the following effects:

  - Dizziness
  - Stupor, euphoria
  - Vomiting/unconsciousness

  If taken in sufficient quantities, the fumes of these substances can cause serious damage to internal organs and ultimately death by suffocation.

Effects of drugs and other chemicals on driving behavior. It is apparent from the foregoing description that the symptoms that can be produced from the use or abuse of certain drugs and chemicals are similar to those of alcoholic influence. Thus, erratic and unusual driving behavior of an individual who is under the influence of some drug can be very similar to that of a person under the influence of alcohol. When a patrolman observes a driver operating his vehicle in an unusual and erratic manner, pulls such a driver over, and detects none of the strong indications of alcoholic influence (e.g., smell of an alcoholic beverage, physical signs of drinking, etc.) nor has reason to suspect injury or illness, he should be alert to suspect "driving under the influence of drugs."

Alcohol Combined with other Drugs

When alcohol is combined with some drugs, the effect is not simply additive but sometimes supra-additive or "synergistic." In other words, you sometimes get more impairment from an alcohol-drug combination than you would expect from a simple addition of the effects of each dose alone.

Stimulants. They do not counteract the major depressing effects of alcohol. They are only temporarily effective with regard to the grosser aspects of alcoholic influence, and may be used for temporary arousal in severe intoxication, but the arousal effect is brief.

Depressants. The depressant effects will be added together and, in some instances, the resultant effect will be greater than the expected combined effect of the two drugs. The trainee should be alert to the fact that depressants are used widely and indiscriminately and their use with alcohol could cause a serious problem for the driver.

Narcotics. Animal studies have indicated additive and supra-additive effects of narcotics and alcohol; human studies are understandably lacking. In examining the drinking driver suspect, the trainee should be alert to the possibility that the individual's behavior may be due to a narcotic or to a combination of narcotic and alcohol.

Other Physical Impairments

There are naturally occurring physical conditions of the driver and pedestrian that can impair traffic performance. Often the symptoms of these conditions resemble those associated with alcoholic or drug influence.

Fatigue. We all become generally fatigued from time to time and the effects of fatigue can significantly impair performance, especially driving performance. Traffic accidents due to fatigue impairment are a common problem on limited access highways where the traffic situation is monotonous and boring. Some of the specific effects of fatigue are:

- Increased time to perceive and react to situations in the environment
- Need for stronger levels of stimulation for awareness
- Tendency to fix attention and vision straight ahead
- Mild forms of hallucinations
- Semiconscious behavior--poor directional control of a vehicle

Illness and injury. There are many forms of illnesses and injuries that can impair traffic performance, many producing symptoms similar to alcoholic influence, some examples of these conditions being:

- Epilepsy
- Narcolepsy (excessive inclination to sleep)
- Diabetic coma
- Cerebral hemorrhage
- Heart attack
- Concussion

Some of the symptoms that can be produced from the above conditions are:

- Slurred speech
- Incoherency
- Loss of physical coordination--staggering

The patrolman should be alert to consider injury or illness as a cause of impairment in cases where symptoms of violator impairment do not appear attributable to alcohol. The patrolman should be particularly careful to medically verify the condition of an impaired individual who has been in a traffic accident, where the signs of alcoholic consumption are weak or non-existent.

Ageing. It is a well known fact that as the individual grows old (60's and beyond), the sensory (especially vision and hearing) and physical capabilities diminish (e.g., reflexes and reaction time are slowed). Many drivers fail to compensate for their impairments due to advancing age or in some cases overcompensate by unduly cautious and conservative traffic performance. In either case, hazardous traffic situations can ensue. The person who is unaware of his limitations produced by advancing age can subject himself to traffic situations in which he does not have full control (e.g., drives too fast for his abilities). The person who is aware of his limitations and performs in an unduly conservative manner, can cause more capable individuals to take chances to escape the influence of this person (e.g., a person who drives too slowly for the traffic conditions).

CHARACTERISTICS OF THE MENTALLY IMPAIRED VIOLATOR

There are emotional states of mind and personality characteristics of "normal" persons which can impair their traffic performance. There also exists the possibility that the "mentally ill" may find their way into the traffic scene.

Temporary emotional states. Everybody from time to time is temporarily affected by a strong emotional state, which can often reduce his normal performance effectiveness. Anxiety/worry, aggression/hostility, elation/exuberance and grief are examples of commonly occurring strong emotional states that can preoccupy one to the extent that the attention required for safe traffic performance is sacrificed. These states can be aroused prior to involvement in the traffic situation (e.g., business or family experience) or during the traffic situation (e.g., frustrating traffic experience, personal conflicts with the occupant of a vehicle).

Mental illness. It is obvious from the foregoing that in the more severe cases, the mentally ill person's traffic performance will be impaired. The patrolman who suspects that a traffic violator is mentally ill must exercise considerable tact, discretion and firm direction to see that this person is removed from the traffic scene and receives medical attention.

Personality characteristics. The more or less prevailing attitudes and outlooks that make for individual differences in personality, play an important role in traffic performance. The individual who has the attitude of respect for authority/rules and regulations is likely to be more mindful of traffic rules and regulations than someone who has disdain for authority and regulatory procedures. The self-centered egotistical individual often lacks concern for the welfare of others and the traffic rules developed to insure the general welfare. He may use an automobile as a means for expressing feelings of superiority by competitive driving (e.g., the "roadhog," the "hornblower"). He lacks patience, is easily frustrated and is often compelled to take risks in traffic to serve his needs. He frequently has the need to show off in traffic by driving in a reckless manner (commonly observed in young drivers). He may be so concerned and preoccupied with himself that his attention is not properly directed to the traffic situation.

The overly cautious and introverted individual lacks the confidence and self-assurance necessary for effective traffic performance. His erratic and unsure performance in traffic often provokes "good" drivers into taking risks to avoid further contact with the driver. A person of this nature frequently lacks the psychomotor skills for smooth coordinated traffic performance.

DETECTING TRAFFIC VIOLATIONS

General Principles of Observation

The patrolman should be ever mindful of the fact that he is the eyes and ears of the police force. He must discipline himself to maintain an alert and watchful view of his environment at all times.

Situations requiring keen observation and memory. The patrolman must be prepared to observe, mentally note and record many situations in the traffic environment, some of which are:

- The license plate (state, number), color, make (year and manufacturer), and model of automobiles
- The location and description of various landmarks on his patrol as well as unusual circumstances (skid marks or signs of an accident where none is reported, malfunctioning or obliterated signs, signals or road markings, etc.)
- Estimation of time, distance, speed, and weight (vehicle overload)
- Detection of unsatisfactory traffic flow conditions
- Descriptions of people (height, weight, age)

The patrolman should practice the foregoing mental tasks whenever and wherever possible while on patrol, so that these skills will be developed and available when he needs them. Where he is inclined to forget his observations, he should promptly write them down in his notebook.

Keen observation takes conscious effort. The primary sensory mode is the patrolman's vision. The patrolman must discipline himself to remain visually attentive and alert. He should be continually scanning his field of view, avoiding fixating his gaze for any period of time. He should look for such things as unusual vehicular positions and movements, objects or markings on or along the roadway that may be indicative of a traffic violation or accident. The motor patrolman should frequently check his rear and side view mirrors for events that may be occurring in back of him. Attention to unusual sounds in the traffic environment is advisable. Hearing will be of more importance to the foot patrolman than the motor patrolman as he generally has more exposure to the sounds of the traffic environment.

Suspicious Driving Behavior

The patrolman must not be content with detecting readily observable violations. There are certain forms of driving behavior and/or vehicular conditions that bear close watching and in some cases qualify stopping the motor vehicle operator for a license and registration check. Unusual driving behavior may be indicative of an illegal driver condition such as driving under the influence of alcohol/drugs or serious vehicular defects. Be suspicious of such unusual situations and performance as:

- Unusually slow or high speed
- Slow moving vehicle in left or passing lanes
- Uncoordinated vehicular control
  - Racing engine
  - Erratic speed control
  - Erratic starts and stops--unduly long stops
  - Weaving
  - Failing to slow down properly for an intersection with a blocked view
  - Excessive maneuvering for a parking place
- Employing turn signals when not preparing for a turn
- Overtaking or attempting to overtake several cars at once
- Sudden movements at the approach of police
- Groups of teenagers assembled in two or more vehicles late at night
- Unlighted parked cars with engines running
- Improperly mounted and/or obscured license plates
- Close following of vehicles at or near speed limit

- Repeated use of horn in traffic
- Frequent cutting in and out of lanes

When and Where to Look for Traffic Violations

Traffic violations can occur anywhere at any time and thus the patrolman should be continually vigilant for the detection of offenses. However, certain violations can be expected to occur more often at certain times and places.

Driving under the influence of alcohol/drugs. This offense is prevalent in the vicinity of night clubs/taverns, recreational/resort facilities dispensing alcoholic beverages; public events such as sporting events, fairs, music/folk festivals, especially where young people in groups would be inclined to abuse alcohol and/or drugs. Weekends, holidays, paydays, evening hours (especially Friday and Saturday nights) are the times when drinking driving offenses are most frequently encountered.

Reckless driving. This offense is often associated with an accident or locations frequented by young drivers, and may be likely to occur when traffic density (vehicular and/or pedestrian) and weather make for hazardous road conditions.

Position and direction on the road. The patrolman may have occasion to note this type of offense where people would be inclined to drive in the wrong direction on the road to take a short cut (e.g. entrances to parking areas such as sports areas, shopping centers, recreational areas), and in the case of traffic accidents. Almost every head-on collision or side swipe involves one or more vehicles travelling in an illegal position on the road.

Right-of-way offenses. These offenses most frequently occur at intersections especially those with high traffic volume. They are often the related cause of traffic accidents.

Speed violations. Such violations are frequently associated with traffic accidents and are often the cause of citizen complaints. Speed violations are often noted on one-way or through streets with light traffic, short cut routes such as secondary roads bypassing congested areas, routes to areas frequented by young drivers (schools, recreational sites, special events), and routes to and from transportation terminals (airports, RR stations) and military establishments. The speeder is frequently detected late Saturday night/early Sunday morning in and near urban centers, during shift changes at factories, and during the opening and closing hours at high schools.

Stopping violations. These violations are commonly noted at arterial/bypass routes that have frequent signalized intersections; intersections having sufficient visibility to tempt a motorist not to stop; intersections near industrial complexes, public roads, transportation terminals or military establishments; and intersections where one street is carrying the through traffic. The patrolman should be alert for stopping violations during the hours of frequent accidents, after public events (sporting events, music festivals, celebrations, etc.), and peak hours of traffic.

Clocking/Pacing of Suspected Speed Violators

The basic tool or technique to enable the motor patrolman to accurately measure the speed of vehicles is the clocking or pacing method.

Clocking procedure. The objective is to match patrol car speed to that of vehicle suspected of speed violation. Maneuver into position behind the suspect vehicle as inconspicuously as possible, avoiding excessive maneuvering. The distance behind the suspect vehicle should be a safe one, allowing for easy license plate identification and control of the pacing procedure. 100 feet behind is satisfactory for speeds up to 25 mph. 200 feet behind is satisfactory for speed of 50 mph and greater. Adjust the patrol car's speed so that suspect vehicle is going slightly faster (pulling away) than the patrol car and record the speedometer. Take a second reading to verify the first reading.

Common errors in clocking procedure. Close scrutiny of the speedometer is required to avoid misreading the clocked speed. Arithmetical mistakes are sometimes made in accounting for any calibration factor. An improper speed match will produce an erroneous reading. If the patrol car is gaining on suspect vehicle at the time of speed reading, the reading will be falsely high. The opposite will be true if a reading is taken when the suspect car is gaining on the patrol car. Higher tire pressure created by a higher environmental temperature will cause falsely low speedometer reading and vice versa.

Consideration for clocking vehicle speed. The patrolman should be mindful that clocking and pursuit are difficult and dangerous in heavy traffic. Clocking should be attempted only when safe apprehension (or pursuit) may be effected.

Key Factors for Detecting Violations

The patrolman must know the traffic law that governs his actions, namely, the various traffic offenses and the elements that define them. He should be aware of times, places and conditions on his patrol that produce certain classes of offenses and take appropriate action. The patrolman must discipline himself to remain alert--to be actively looking for traffic offenses at all times. He should not concentrate TLE efforts at locations where regulatory signs, signals and markings are difficult to perceive, with the intent of taking frequent law enforcement action. It is better to report such deficient situations to the traffic/highway engineering authorities, so that in the interests of highway safety, the appropriate remedial action may be taken. In addition to being careful to identify all the elements of a traffic offense, the patrolman should always note the circumstances surrounding the offense, so as to enable the court to determine the severity of the offense. Such conditions as the following should be noted:

- Time of day
- Road type and condition
- Visibility and weather conditions
- Traffic density (vehicles, pedestrians)
- Visibility/proximity of signs, signals and markings related to the offense

Finally, the patrolman should look for opportunities to obtain the statements of witnesses to substantiate the facts surrounding the offense.

Exhibit 4-3

Stopping and approaching the traffic violator*

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*Traffic Institute, Northwestern University. Stopping and approaching the traffic violator. Traffic Law Enforcement Series. Evanston, Illinois: Author, 1958.

Exhibit 4-4

Officer-violator relationships*

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*Traffic Institute, Northwestern University. Officer violator relationships. Traffic Law Offenses Series. Evanston, Illinois: Author, 1969.

Exhibit 4-5

Taking law enforcement action*

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*Traffic Institute, Northwestern University. Taking law enforcement action. Traffic Law Enforcement Series. Evanston, Illinois: Author, 1958.

Section 5.0

ACCIDENT MANAGEMENT

ACCIDENT MANAGEMENT BACKGROUND

Introduction

"Accident management" is a designation for the police responsibilities concerned with the control and normalization of a traffic accident scene, the identification and documentation of the facts surrounding the accident, and the determination of contributing factors or related causes. The primary accident management tasks which are carried out or supervised by the patrolman are:

- Render first aid as necessary to the victims of a traffic accident
- Establish safe passage for roadway traffic
- Gather and document facts surrounding the accident
- Determine the contributing factors of the accident
- Take any warranted law enforcement action
- Normalize the roadway environment affected by the traffic accident

Accident Reporting

Accident reporting basically involves identifying and recording the relevant information about an accident on the "accident report form." Accident report forms are the convenient and standardized means for storing such accident related information as:

- Who was involved
- What was involved, e.g., vehicle positions and pathways, extent of injury or damage, environmental conditions, conditions of vehicles and drivers
- Where the accident occurred
- When the accident occurred

Much of the information for routine accident reports can usually be obtained from driver licenses and vehicle registration forms.

Accident Investigation

Accident investigation involves the use of thoroughly reported and accurate accident related information to draw conclusions and form opinions about:

- How the accident happened
- Why the accident happened

The information for accident investigation is more extensive than that required for routine accident reporting. The analysis of such detailed information as reports from drivers and witnesses, photographs, measurements, accident diagrams and the physical conditions/evidence is usually necessary to:

- Reconstruct the accident and identify the operational factors that contributed to the accident--determine how this accident occurred.

- Identify the condition factors that contributed to the accident--determine why the accident occurred.

- Determine if law enforcement action is required. Law violations discovered as a result of an accident investigation are of three basic types:

  - Contributory traffic violation -- one which contributes to the accident such as excessive speed, failure to yield the right-of-way, following too closely, etc. This form of violation is often the operational factor that contributed to an accident, especially if the violation is a moving violation.

  - Non-contributory traffic violation--one which did not contribute to the accident, such as driving without a license or registration.

Non-traffic violation--a non-accident related violation, such as the transportation of stolen merchandise, stolen car, etc.

Accident Terminology

The patrolman should have a grounding in basic "accident terminology," so that a standard level of discussion may be achieved in his accident reporting and investigation efforts. The definitions for the terms originate from the National Safety Council's publication entitled, Manual on classification of motor vehicle traffic accidents (2nd ed., 1970), to which the student may refer for more detailed terminology.

Accident. This is "an unintended event that produces injury or damage. The word 'injury' includes 'fatal injury.'"

Motor vehicle accident. This is "an accident involving a motor vehicle in transport, but not involving aircraft or watercraft." More specifically, this term includes such situations as:

- Collisions with:
    - Another motor vehicle (in transport or parked)
    - Pedestrian
    - Other road vehicle
    - Animal
    - Object which is fixed, movable, or moving
    - Railway train
- A motor vehicle overturns without any preceeding collisions
- A motor vehicle sets something in motion which collides with something, without the motor vehicle doing the actual striking (e.g., parts of a vehicle, cargo, occupants, etc.)
- A motor vehicle is involved in a non-collision accident involving:
    - Poisoning by carbon monoxide from motor vehicle
    - Person falling, jumping, or being pushed
    - Fire in motor vehicle, explosion
    - Broken part of motor causing injury or danger, etc.
    - Broken glass caused by a propelled hard object (rock, metallic part)

This term excludes injury or damage due to:

- Natural occurring events (e.g., flood, hurricane, tornado, lightning)
- Events occurring when the motor vehicle, not under its own power, is being loaded or unloaded from another conveyance
- Intentional damage or injury using motor vehicle
- Injury or damage intentionally inflicted by law enforcement agents

Motor vehicle traffic accident. This refers to "any motor vehicle accident that occurs on a trafficway or that occurs after the motor vehicle runs off roadway but before events are stabilized." Related to this concept are the following terms:

- Trafficway--"is the entire width between property lines, or other boundary lines, of every way or place, of which any part is open to the public for purposes of vehicular travel as a matter of right or custom."
- Road--"is that part of a trafficway which includes both the roadway and any shoulder alongside the roadway."
- Roadway--"is that part of a trafficway designed, improved, and ordinarily used for vehicular travel. In the event the trafficway includes two or more separate roadways, the term 'roadway' refers to any such roadway separately, but not to all such roadways collectively."
- Shoulder--"is that portion of the road contiguous with the roadway for accommodation of stopped vehicles, for emergency use, and for lateral support of the roadway structure. The line between the roadway and the shoulder may be a painted edge line, a change in surface color or material, or a curb. On some modern trafficways, there may be a surfaced shoulder on the right side, and frequently a narrower shoulder on the left side of a one-way roadway."

- Chain reaction accidents. "Sometimes, in the same area and within a short time, several motor vehicles may be involved in accidents during an adverse driving condition, such as reduced visibility due to fog. In such chain reaction accidents, it is frequently difficult to determine afterward whether this event was one accident without a moment in which the accident situation was stabilized, or whether several accidents occurred with the accident situation stabilized, between separate accidents. Consequently, for purposes of uniformity, consider such chain reaction accidents to be single motor vehicle accidents, unless a stabilized situation can be established between the several events that may occur in such chain reaction accidents."

- Deliberate intent. In cases when a motor vehicle is in transport and some person or persons intend that events should occur, such events are excluded from the classification of motor vehicle accidents. The two major examples of this exclusion are:

  . Suicide or self-inflicted injury
  . Homicide or purposely inflicted injury or damage

Major types of motor vehicle traffic accidents. The following eleven categories of motor vehicle traffic accidents may occur on or off the roadway. Study Guide Exhibits 5-1, 5-2 and 5-3 illustrate some of these situations.

. Non-collision involving a motor vehicle in transport

  - Overturning

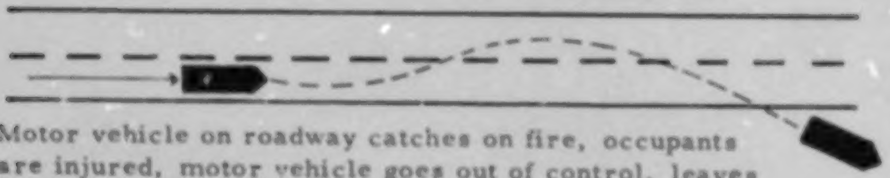
  - Other (e.g., CO poisoning; explosion; fire; falling, jumping or being pushed from vehicle)

. Collision between motor vehicle in transport and:

  - Pedestrian
  - Motor vehicle in transport
  - Motor vehicle on other roadway
  - Parked motor vehicle
  - Railway train
  - Pedalcyclist

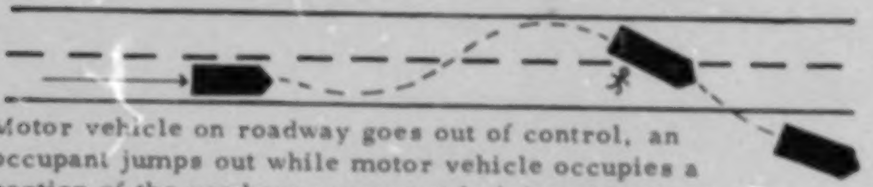
Exhibit 5-1
Non-collision events*

1. On Roadway - Other Noncollision



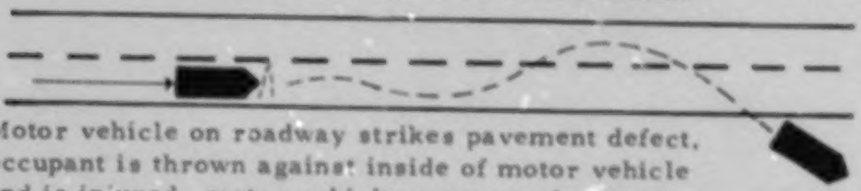
Motor vehicle on roadway catches on fire, occupants are injured, motor vehicle goes out of control, leaves the roadway, and overturns.

2. On Roadway - Other Noncollision



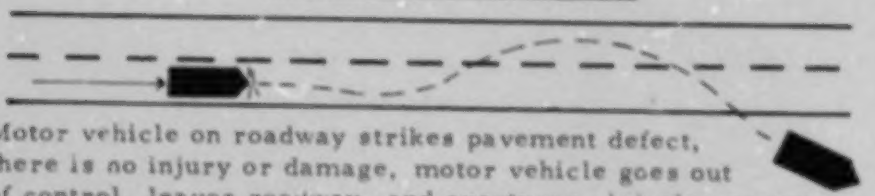
Motor vehicle on roadway goes out of control, an occupant jumps out while motor vehicle occupies a portion of the roadway, occupant is injured in the jump, motor vehicle leaves the roadway and overturns.

3. On Roadway - Other Noncollision



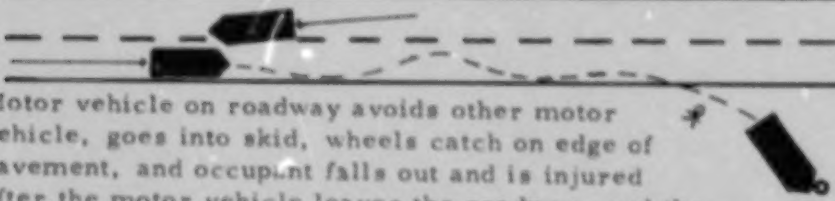
Motor vehicle on roadway strikes pavement defect, occupant is thrown against inside of motor vehicle and is injured, motor vehicle goes out of control, leaves roadway, and overturns.

4. Off Roadway - Overturning



Motor vehicle on roadway strikes pavement defect, there is no injury or damage, motor vehicle goes out of control, leaves roadway, and overturns, injuring occupants.

5. Off Roadway - Other Noncollision



Motor vehicle on roadway avoids other motor vehicle, goes into skid, wheels catch on edge of pavement, and occupant falls out and is injured after the motor vehicle leaves the roadway, and the motor vehicle runs into a tree.

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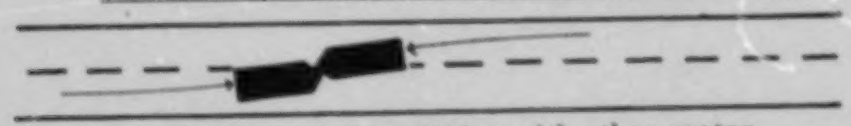
*Source: Figure 5, page 56, Manual on classification of motor vehicle traffic accidents (C) 1970, National Safety Council, Chicago, Illinois, used with special permission.

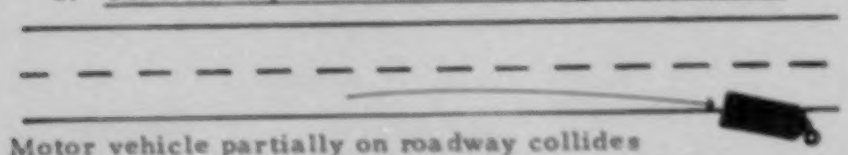
Exhibit 5-2
Single collision events*

1. On Roadway - Collision Involving Motor Vehicle



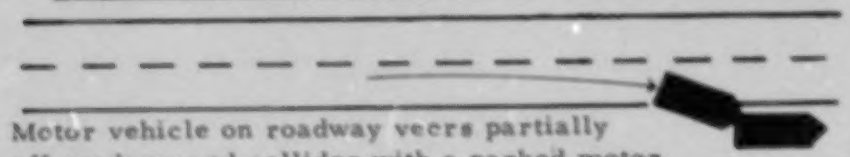
Motor vehicle on roadway collides with other motor vehicle on roadway, resulting in injury and damage.

2. Off Roadway - Collision Involving Fixed Object



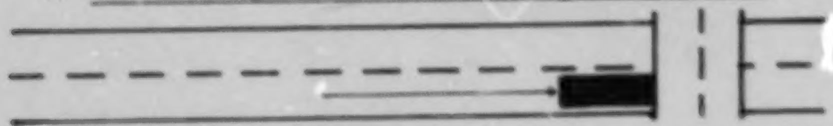
Motor vehicle partially on roadway collides with a tree off the roadway, damaging the motor vehicle and injuring occupants.

3. Off Roadway - Collision Involving Parked Motor Vehicle



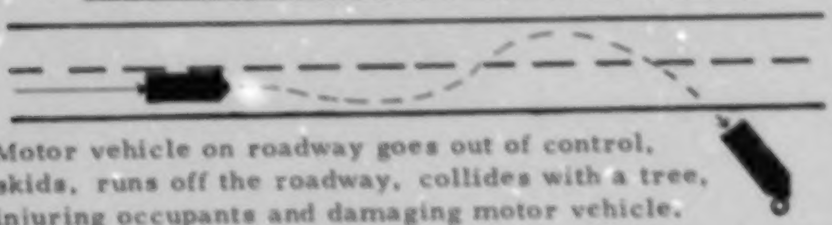
Motor vehicle on roadway veers partially off roadway and collides with a parked motor vehicle off roadway, injuring occupants and damaging motor vehicles.

4. On Roadway - Collision Involving Fixed Object



Motor vehicle (overheight truck) on roadway drives under an overpass and the top of the truck strikes the overpass, damaging the motor vehicle.

5. Off Roadway - Collision Involving Fixed Object



Motor vehicle on roadway goes out of control, skids, runs off the roadway, collides with a tree, injuring occupants and damaging motor vehicle.

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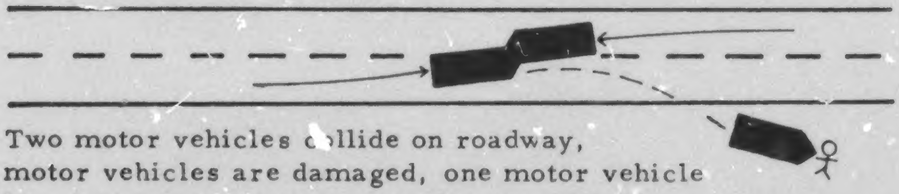
*Source: Figure 6, page 57, Manual on classification of motor vehicle traffic accidents © 1970, National Safety Council, Chicago, Illinois, used with special permission.

Exhibit 5-3

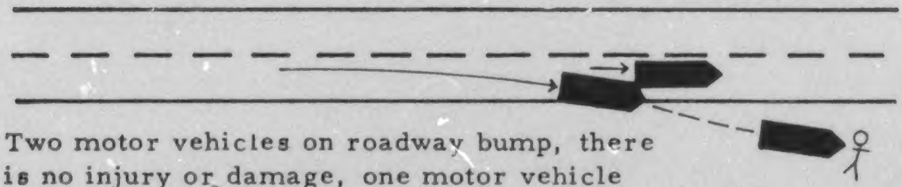
Multiple collision events*

1. On Roadway - Collision Involving Motor Vehicle



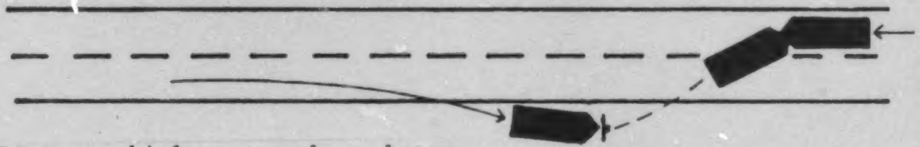
Two motor vehicles collide on roadway, motor vehicles are damaged, one motor vehicle leaves roadway, runs onto sidewalk, and injures a pedestrian.

2. Off Roadway - Collision Involving Pedestrian



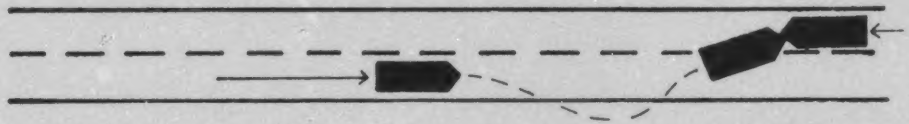
Two motor vehicles on roadway bump, there is no injury or damage, one motor vehicle leaves the roadway, runs onto sidewalk, and injures a pedestrian.

3. Off Roadway - Collision Involving Fixed Object



Motor vehicle on roadway leaves roadway, knocks down a breakaway traffic sign, damaging motor vehicle and sign, returns to roadway, collides with motor vehicle on roadway, injuring occupants and damaging motor vehicles.

4. On Roadway - Collision Involving Motor Vehicle



Motor vehicle on roadway runs off roadway, there is no injury or damage, motor vehicle returns to roadway and collides with another motor vehicle on roadway, injuring occupants and damaging motor vehicles.

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*Source: Figure 7, page 58, Manual on classification of motor vehicle traffic accidents © 1970, National Safety Council, Chicago, Illinois, used with special permission.

  - Animal
  - Fixed object
  - Other object (streetcar, animal carrying person, etc.)

Severity of motor vehicle traffic accidents. The categories applied to the classification of the extent of injury and damage resultant from a motor vehicle traffic accident are:

. Injury severity

  - Fatal
  - Incapacitating
  - Non-incapacitating (evident)
  - Possible injury
  - No injury

or

  - Fatal accident
  - Non-fatal injury
  - Non-injury (damage only)

. Damage severity

- Disability	Motor vehicle
- Functional	
- Other motor vehicle	
- Other property	Other property
- No damage	

Anatomy of an Accident

Accident events. Every accident is brought about by a sequence of events--a sequence of unexpected and uncontrolled events that leads to damage and/or injury. An understanding of these typical classes of events or phases, will help the patrolman in his investigation of the causes of and circumstances surrounding a traffic accident. The basic categories of events are listed below; not every accident has all of these events and these events do not always occur in this order:

. Point of possible perception (of hazard)
. Point of actual perception (of hazard)
. Point of no escape
. Key event/key point
. Point of initial engagement

- Point of maximum engagement
- Point of disengagement
- Final position

Study Guide Exhibit 5-4 illustrates the occurrence of these events for a right angle collision, and a detailed discussion of each event appears below.

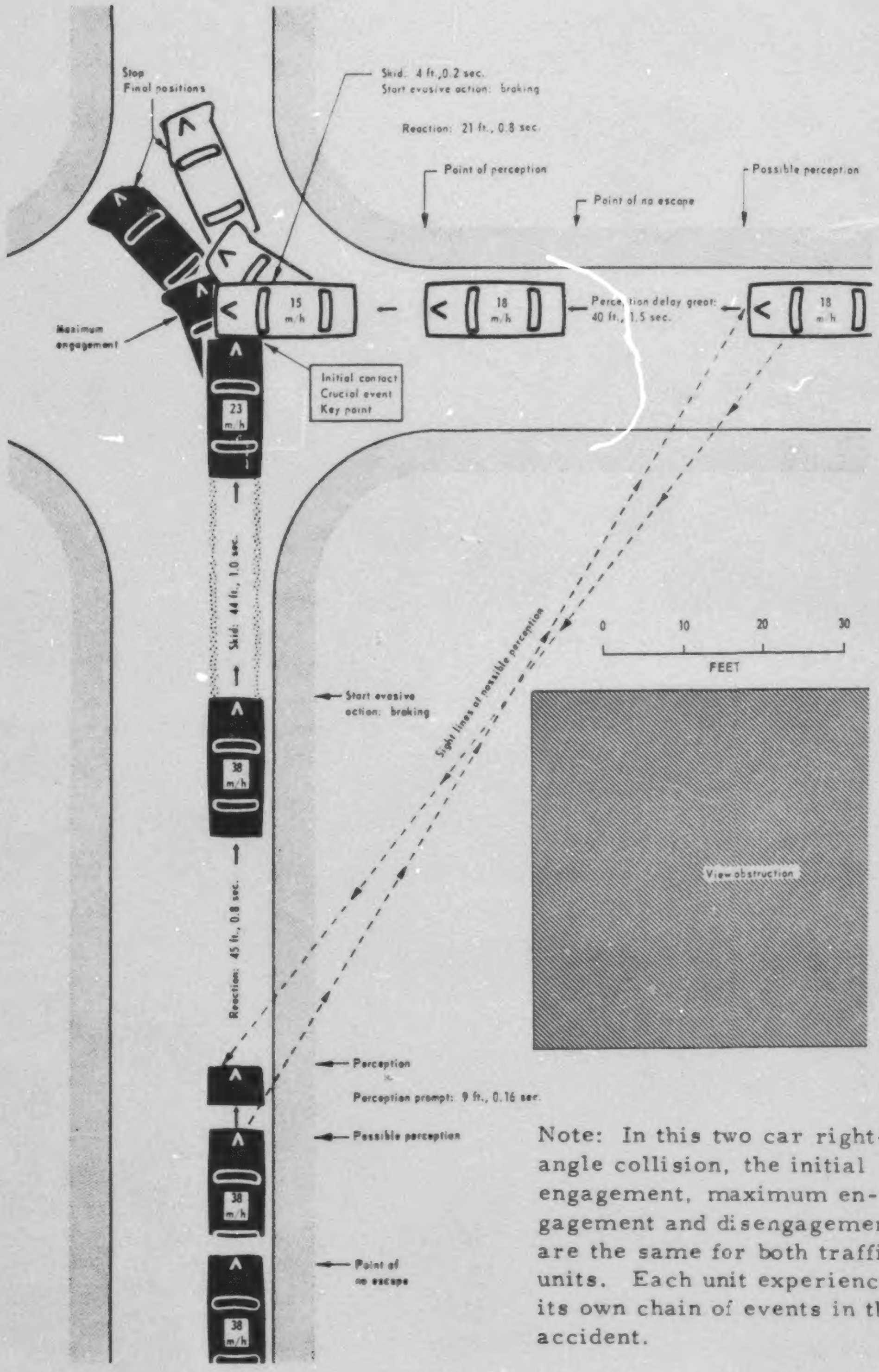
- Point of possible perception. This is the time and place at which the hazardous situation could have been perceived by a normal person. This point always precedes the point of actual perception. Perception time is the time between point of possible perception and point of actual perception. Maximum delay of perception is achieved when a traffic unit does not perceive a hazard until physical contact is made.

- Point of actual perception of hazard. This is the point at which an individual sees, feels, hears or otherwise perceives an indication that an accident is about to occur (e.g., seeing an opposing vehicle cross the barrier line, hearing a horn on your left as you are about to change lanes, feeling the right wheels drop from the road to a soft shoulder, or feeling the start of a skid). The points of possible and actual perception are analyzed to determine the contribution of drivers and pedestrians to accidents. The time between the two points is of particular interest. The point of actual perception identifies the point at which evasive action should be taken.

- Point of no escape. This refers to the place and time after which a given individual cannot avoid or prevent an impending accident. Occasionally, the point of perception and point of no escape are one in the same. In other cases, the point of no escape precedes the point of perception. Frequently, the point of no escape follows the point of perception, indicating faulty judgment and/or skill in the execution of evasive action.

- Key event/key point. This is the event which determines the time, place, and type of accident that will occur. It is whichever of the following classes of events that occurs first:

Exhibit 5-4
Anatomy of an accident*


Stop
Final positions
Skid. 4 ft.,0.2 sec.
Start evasive action: braking
Reaction: 21 ft., 0.8 sec.
Point of perception
Point of no escape
Possible perception
15 m/h
18 m/h
Perception delay great: 40 ft., 1.5 sec.
18 m/h
Maximum engagement
Initial contact
Crucial event
Key point
23 m/h
Skid: 44 ft., 1.0 sec.
Start evasive action: braking
38 m/h
Sight lines of possible perception
0
10
20
30
FEET
View obstruction
Reaction: 45 ft., 0.8 sec.
Perception
Perception prompt: 9 ft., 0.16 sec.
Possible perception
38 m/h
Point of no escape
38 m/h

Note: In this two car right-angle collision, the initial engagement, maximum engagement and disengagement are the same for both traffic units. Each unit experiences its own chain of events in the accident.

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*Source: Exhibit 11-2, page 11, Traffic accident investigator's manual for police © 1963, Northwestern University, Evanston, Illinois, used with special permission.

- Non-collision on the roadway
- Collision on the roadway

- Point of initial engagement. This is the point where contact is first made during a collision. Before this point, no mutual force is exerted between the objects. After this point, force begins to develop.

- Point of maximum engagement. This is where the greatest collapse of material or overlap of objects occurs. The greatest force is exerted between objects at this point. This always follows the key event, and immediately follows the initial engagement.

- Point of disengagement. This refers to the point at which the objects or units involved in the collision start to separate from one another, and the initial force exerted between them ceases. Complete disengagement does not occur in all accidents.

- Final position. This is the time and place that the objects which have collided come to rest, without the use of any power. This position may be difficult to determine if vehicles leave the scene, or roll down an incline after engagement. Vehicles may still be engaged at the final position. Often the final position of passengers or cargo may be quite different from the vehicles in question. The final positions of vehicles and related objects are quite useful in reconstructing the accident. Traffic units do not have a "final position" if power is applied to move them. Drivers often move their vehicles to a safer position after a collision.

Accident times and distance. Of significant importance to accident investigation are the intervals between events, and their corresponding distances. Reaction time is the time from actual perception to the start of evasive action (e.g., application of a foot to a brake pedal, or the turning of a steering wheel). Reaction distance is the distance moved during the reaction time interval.

Concluding remarks. The patrolman should learn to think about an accident in terms of the previously explained system of accident events. Although not all events may be present in every accident or in the same order, the patrolman should be alert to identify all events so that he may have a complete and valid understanding of the "anatomy of an accident."

Causes of Traffic Accidents

Finding the causes of accidents, the how and why, is the major purpose of accident investigation. The cause of an accident is defined as "a combination of simultaneous and sequential circumstances (factors), without any one of which, the accident could not have happened." The source of causes of an accident can come from any one or all of the three elements of the highway transportation system: the people, the vehicle, and the trafficway. These sources produce contributing factors or accident causes.

Operational factors. These are sometimes called "direct" causes of accidents and include such activities as control of traffic units within established paths of the roadway, and driving strategy, e.g., the adjustment of maneuvers and speed to roadway and environmental conditions. In more specific terms, these factors relate to inadequacies in the following areas of traffic unit control:

- Perceiving situations requiring action
- Deciding upon an appropriate course of action
- Responding to the situation with the correct action

To determine at which point safe operations have failed, will enable the accident investigator to determine how the accident occurred.

Specific sources of operational factors. Delayed perception or unresponsiveness to the traffic situation caused by preoccupation, distraction, or sensory interference, is often identified as an operational factor. Violations of traffic laws which define an optimum and safe driving strategy, are a source of many operational factors, especially those laws dealing with the "rules of the road." Evasive action is the reaction of a traffic unit to avoid a hazardous situation that is likely to result in a collision. Evasive action may be completely successful (the accident is avoided), partially successful (a likely serious accident is reduced to a minor accident), or unsuccessful (a serious accident

> results). The major types of evasive action that may be used singly or in combination are slowing or stopping, speeding up, backing and turning right or left. Common forms of ineffective evasive action are wrong actions such as making a wrong turn, sounding the horn instead of maneuvering, braking instead of speeding up, etc. In addition, there can be delayed actions due to indecision and confusion, or the expectation that the other traffic unit will stop or change course.

Condition factors. These are sometimes referred to as "mediate" causes of accidents and include deficiencies in the ideal characteristics or attributes of the trafficway, people and the vehicle. Examples of attributes are:

- Trafficway--traction available
- People--psychomotor skills in maneuvering the vehicle
- Vehicle--braking effectiveness

The attributes of factors can be modified by other conditions called "modifiers." Modifiers change the attributes of the trafficway, people, or vehicle from a satisfactory state to a generally hazardous state. Examples of modifiers are listed below:

- Trafficway--ice or rain on road surface

- People--intoxication or fatigue

- Vehicle--leakage of brake fluid, extreme wear of brake lining, worn tires

Discovering the deficiencies in the attributes of major classes of condition factors will enable the patrolman to explain why safe operations failed, as these deficiencies in condition factors attributes influence the operational factor(s) or direct cause(s) of the accident. Study Guide Exhibit 5-5 shows some examples of attributes and modifiers for the trafficway, people and the vehicle. The lists of factors presented in this exhibit are not exhaustive, but serve as examples only. The distinction between attributes and modifiers is not always precise. Some modifiers act quickly, some act slowly. Some have a permanent effect, others have a temporary effect. Attributes vary from time to time, due to the changing nature of the modifiers. A temporary modifier like blood

Exhibit 5-5

Condition factors - attributes and modifiers*

Trafficways			
Attributes		Modifiers	
Generally relating to Performance	. Alignment . Surface character . Dimensions . Restraining devices	Temporary	- Weather, atmospheric conditions - Natural light - Temporary warning devices - Temporary roadside activities - Roadside objects - Objects on the road - Loss of alignment - Social and legal symbols - Surface deposits, ruts - Road damage, holes
Generally relating to Decision	. Signals . Traffic signal controls . Regulatory signs and markings		
Generally relating to Recognition	. Light . Visibility . View obstructions . Recognizability . Recognizability aids . Distractions, monotony . Confusion, standardization . Warning signs . Guide signs	Permanent	- Wear - Deterioration, age
People			
Attributes		Modifiers	
Generally relating to Performance	. Operating skill, habits . Size, weight, strength . Freedom of movement	Temporary	- Sun exposure - Glasses, etc. - Emotional upset - Pressure, stress, hurry - Preoccupation - Weather - Irritants - Ingestion, inhalation - Fatigue, boredom - Temporary illness - Injury - Clothing - Things carried - Prosthetic devices
Generally relating to Decision	. Intelligence, judgment . Attitudes . Emotional stability . Alertness, concentration		
Generally relating to Recognition	. Observing habits . Sensory abilities . Signaling habits . Recognizability (mainly pedestrian) . Knowledge	Permanent	- Deterioration, age - Chronic illness - Permanent injury - Experience, training - Customs, tradition - Authority, enforcement

Exhibit 5-5 (Continued)
Condition factors - attributes and modifiers*

Vehicles			
Attributes		Modifiers	
Generally relating to Performance	. Control arrangement, function . Operating space . Dimensions . Weight . Performance . Stability	Temporary	- Glare - Weather - Surface deposits - Cargo - Passengers - Social and legal symbols - Adjustment loss, defective parts - Damage, contamination
Generally relating to Decision	. Comfort . Symbolism . Automatic controls		
Generally relating to Recognition	. Recognizability . Recognizability aids . Road illumination . Sensory aids . View obstructions . Distractions . Instruments . Signaling devices . Control feedback	Permanent	- Deterioration, age - Irreparable damage - Wear

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*Sources: Exhibits 11-11, 11-12, and 11-13, pages 36-38, Traffic accident investigator's manual for police © 1963, Northwestern University, Evanston, Illinois, used with special permission.

alcohol has a relatively quick effect on increasing reaction time. A modifier like ageing has a slow but permanent effect on increasing reaction time.

Remote condition factors. These very general and global factors related to a variety of acts or neglect on the part of some person or organization that permits the condition factors to exist. These factors have been called "early causes" of accidents and include the very general yet influential effects of such factors as inadequate driver education programs, ineffective traffic law enforcement, inadequate highway engineering, etc. Determining the effects of remote condition factors on condition and operational factors is a tenuous and difficult task and beyond the scope of a patrolman's normal duties.

Interaction and multiplicity of causes. There must be at least one operational and condition factor present to cause an accident. Usually several of each are necessary to cause a traffic accident. Thus, a combination of several factors is usually responsible for an accident. It is therefore not always easy to identify the most important factor or cause of an accident; when an attempt to do this is made, usually the most conspicuous or controllable factor is identified.

Commonly Discussed Causes of Accidents

Some of the frequently identified causes of accidents are discussed below.

Speed. Speed could be considered a factor in every traffic accident, since without movement, two bodies cannot collide. Inappropriate or unsafe speed for the conditions of the highway transportation system is really the key point to note. Inappropriate speed may result in the inability for a vehicle to negotiate a curve without skidding or leaving the road. Excessive speed can provide an element of surprise and hazard for the driver, such that he is beyond the point of no escape at his point of perception. For example, high speed may preclude a driver from successfully evading an unexpected obstacle. On a high speed roadway, a slowly moving or stopped vehicle can present a real hazard. There is a very definite and commonly observed relationship between speed, delayed perception, and inadequate evasive action. Delayed perception, as such, is not a specific traffic offense in most jurisdictions. It is often referred to or covered in laws which make "careless," "reckless," or "driving so as to endanger" illegal.

Failure of the driver to cope with the traffic situation. There are several ways in which driver performance can contribute. Carelessness is a factor which can apply to such attributes of individuals as lack of skill, but largely refers to an attitude of disregard or inattentiveness to important features of the highway environment that is required for safe travel.

Negligence is basically the same as carelessness but more associated with specific law violations.

Recklessness generally refers to a "willfull or wanton disregard for the safety of persons or property." It can be an operational factor in terms of the decision making performance of an individual. It also can be an attribute of an individual such as attitude, state of emotional instability, etc.

Specific violations of traffic laws. Most hazardous behavior on the part of drivers/vehicles and pedestrians constitutes a violation of one traffic law or another. Most hazardous conditions of vehicles and drivers constitute violations of traffic laws. Police and legal authorities tend to think of accident causes as specific violations of traffic laws. Many accident report forms call for only law violations as accident causes. Some of the frequently occurring contributing factors identified by law enforcement agencies as major causes of accidents are:

- Speed too fast for conditions
- Failure to yield right-of-way
- Failure to keep safe distance (following too closely)
- Drove left of center
- Made improper turn
- Improper overtaking
- Improper lights; defective brakes or steering
- Ignored traffic control device
- Drove while under the influence of alcohol or drugs

Purposes of Accident Reporting and Investigation

The information forthcoming from the conscientious efforts of police in reporting and investigating accidents will directly support several activities. For instance, it is necessary to identify and document the causes and circumstances of accidents so that accidents may be prevented or reduced in the future through improvements in such accident prevention programs as:

- Traffic law enforcement
    - Selective enforcement by police with respect to the time, place, and frequency of accidents and associated traffic law violations
    - Prosecution in the courts
- Traffic engineering
- Traffic education
    - Driver education
    - Public safety education
- Highway safety research
- Traffic legislation
- Driver regulation/licensing

Moreover, accident reporting and investigation enables the patrolman to make a responsible decision as to whether there is sufficient evidence of law violation associated with an accident to take law enforcement action. Finally, the results of police accident investigation and reporting are often of interest to claims attorneys and adjusters, in civil proceedings to determine whether there was any negligence on the part of the operators involved, so that damage claims may be equitably adjusted. Claim settlements constitute "big business" in the U.S.A. and Europe. It has been estimated that half of all motor vehicle accidents involve claims litigations. Since police are in the strategic position to obtain first-hand information about the circumstances of an accident, patrolmen are often called upon to supply accident facts for these proceedings.

Attributes of a Good Accident Investigator

The patrolman should exhibit certain qualities and attributes, during the conduct of an accident investigation, which will increase the chances for obtaining the most complete and accurate description of the circumstances surrounding the traffic accident.

Investigative activities for the patrolman. During the investigation, the patrolman is basically concerned with seeking facts, recording information (via accident report and other official forms), and forming opinions. In seeking information and facts, the patrolman will be involved in asking questions and listening carefully to what people say, looking critically at the physical conditions of the accident scene, measuring lengths of roadmarks and distances between objects, feeling things--like the temperature of a radiator to determine how long the engine has been stopped, and smelling odors to determine the character of substances (e. g., flammable substances, water, burned rubber, etc.). How much information the patrolman can obtain is variable. If only the accident report is to be executed, then a minimum of information is required. If the patrolman is to draw conclusions about the accident for law enforcement purposes, then he will need more information. Sometimes an insignificant accident (for law enforcement purposes) results in a major civil suit involving the at-the-scene officer's observations. The patrolman, to protect himself and the department, should investigate every accident as fully as necessary. Recording information will involve completion of the accident report forms and supplementary field notes, as well as the taking of photographs where useful. Photographs should never be though of as a substitute for keen observation and the documentation of physical conditions. In forming opinions, the patrolman will analyze and evaluate the body of facts he has assembled, to reconstruct the accident as well as find the cause (s) of the accident.

Qualities of a good accident investigator. A good accident investigator is one who is intelligent, observant, energetic, determined, skeptical, patient and diplomatic.

The patrolman should develop habits of objective and critical thinking. In the information that he secures or receives, he must learn to separate opinion from fact. Webster's dictionary defines a fact as "something that has actual existence: an actual occurrence: ... information having objective reality." As valuable as it is, the patrolman should always be skeptical of the information about an accident contained in the reports of people at the scene. People may have ulterior motives and consciously distort the truth or unwittingly distort the facts. Reported information should always be correlated with observed physical conditions and evidence. In the accident report form and supplementary field notes, the patrolman should record only facts, where indicated, to the best of his ability. Any evaluations made by the patrolman may be expressed in any law enforcement action he might take or any supplementary accounts of the accident he may develop. When arriving at conclusions, the patrolman should be careful to identify the facts which led him to his conclusions.

The good investigator should be careful to distinguish between the circumstances surrounding an accident and the factors which contributed to the accident. Because a patrolman discovers that one of the drivers in an accident had consumed an alcoholic beverage, he should not jump to the conclusion that the accident was caused by a driver who was "under the influence of alcohol." All the facts surrounding an accident must be considered.

The patrolman should never let his prejudices affect his investigative procedures. The personalities of individuals should never sway the patrolman from his objective evaluation of the accident scene. Although a traffic accident is often the result of a violation of one or more traffic laws, it is not always the case. Unless the evidence clearly indicates a violation, no charge should be made.

The patrolman should never allow himself to view accident investigation as a routine matter. There is always something unique about every accident. Despite observed similarities between an accident in question and some other one(s) investigated in the past, the patrolman should never abandon a thorough inquiry into the circumstances surrounding the present accident.

The patrolman should never slight his obligation to render assistance at the scene. In most cases, the persons involved in accidents have never experienced an accident before. An accident is a new and frightening experience for the principals, one which the patrolman can ease by showing understanding and being as helpful as possible. If the patrolman exhibits the qualities of patience, tact and understanding, as well as a polite and courteous manner, he will not only help the cause of the principals of the accident, but his own as well. As with a traffic law enforcement stop, the experience of a traffic accident often arouses strong emotions in the parties involved (e.g., fear, anger, etc.). Coping with individuals in emotional states places a great burden on the patrolman. However, the forbearance and understanding of a patrolman at the scene will increase the chances of gaining the cooperation of the principals and witnesses at the scene and make potentially valuable sources of information available to the investigating patrolman. If the individuals involved in an accident leave the scene of an accident feeling that they were fortunate to have had the patrolman there to assist them, then a great service has been done for both the patrolman and his department.

ACCIDENT MANAGEMENT PROCEDURES, PART I
PROCEEDING TO THE SCENE

Enroute Planning Considerations

Learning of an accident. The patrolman will learn of the occurrence of a traffic accident in one of several ways. Frequently, he will learn of an accident while on patrol as a result of a radio call from the dispatcher. A passing motorist may inform him of an accident. Occasionally, the patrolman may come upon an accident or witness the occurrence of an accident.

Obtaining the information about the accident. When getting the assignment to report to an accident scene as a result of a radio call from the dispatcher, the patrolman should be sure that he has as clear an understanding as possible of the following points of information:

- When the accident occurred
- The exact location of the accident
- Severity of the accident, e.g.:
    - Extent of injuries, fatalities
    - Extent of damage, hazards present
- Traffic congestion problems
- Emergency services already summoned to the scene, e.g., ambulance, fire fighting, towing, etc.
- Law enforcement personnel summoned to or already at the scene

Anticipating the situation at the scene. The patrolman should develop a "game plan" enroute to the scene, attempting to "visualize" the scene based on information received and knowledge of the geography of the area. Factors that he should consider to prepare himself are:

- Likely nature and extent of associated traffic congestion
- Possible detours that may be effected to relieve traffic congestion at the scene

- The division of labor among law enforcement personnel at the scene (e.g., what the patrolman should do as well as any supervisory/assisting officers at the scene, etc.)
- Likely nature and extent of any hazards resultant from the accident (e.g., spilled dangerous substances, electrical hazards, flooding, fire, etc.)

Planning the route to the scene. Keeping in mind any anticipated or reported traffic congestion, the patrolman should determine the most expeditious route to the scene of the accident. Considering the traffic situation, the quickest route may not necessarily be the shortest in distance. The patrolman should have area maps and street guides available to help him in making routing decisions. However, these aids are no substitute for intimate first-hand knowledge of the geography of his patrol area. In planning the route, the patrolman should also consider the likely approaches of other emergency vehicles. If it is reasonable to do so, the patrolman should endeavor to make his approach to the scene from the same direction as the one or more vehicles involved in the accident. This will give the patrolman an opportunity to observe the physical conditions in effect (e.g., roadway condition, condition of traffic control devices, etc.). If a "hit and run" situation is suspected, the patrolman should consider approaching the scene along a likely "escape" route, to apprehend the driver.

Proceeding to the Scene

Prompt arrival at the scene is desirous for several reasons:

- There may be injured people requiring first aid and medical attention
- As time passes, people and vehicles gather at the scene causing congestion
- Over time, some potentially valuable witnesses may become disinterested and leave the scene
- Principals involved may collaborate and create alibis to distort the truth

However, a prompt arrival is a safe arrival. It is better to arrive a little later than desired rather than to not arrive at all. If the patrolman is involved in an accident, himself, he deprives the accident scene of his talents as well as tarnishing the image of his department.

Unless instructed by the dispatcher to proceed on an "emergency" basis to the scene, the patrolman should consider employing the following measures when proceeding to the scene.

- Activate dome and flasher lights
- Avoid continuous use of the siren
    - Use siren or horn for short periods of time as necessary to warn traffic of your approach, i.e., when approaching intersections and to allow patrol vehicle passage through lanes of backed up traffic.
    - Continuous use of the siren can give the officer a false sense of security, as well as arousing unnecessary alarm to traffic in the area.
- Proceed at a "reasonable" rate of speed
    - Extraordinary or excessive speed by the patrol car obviously poses a hazard to the patrolman and the public he serves.
    - High speed travel can cause the officer to experience undue tension and anxiety associated with the control of a high speed vehicle. This can put the patrolman in a less than ideal state to manage the accident scene.

Observation of enroute situations and conditions. The patrolman should be alert to note any suspicious looking vehicles leaving the accident scene, as they may be operated by "hit and run" drivers. A suspicious vehicle may be traveling at high speed and/or have sustained recent damage (dented fender, bumper, missing head lamps, etc.). The patrolman should note the make, model, color, and license number (if possible) of any such suspicious vehicles leaving the scene and radio this information to the dispatcher for possible follow-up.

He should note the conditions in the immediate vicinity of the accident scene, which may have been contributing circumstances, such as:

- Low visibility (smoke, fog, haze)
- Character/condition of road surface

- Road obstructions, construction, etc.
- View obstruction
- Status of traffic control devices

Handling enroute hazardous situations. The patrolman should consider the marking of any enroute hazardous situation (accidents resulting from the primary accident, the roadway just prior to the original accident), so as to safely channel the passing traffic. Any accidents observed enroute to the primary accident should be promptly reported to the dispatcher.

Arrival at the Scene

Parking considerations. Once the patrolman arrives at the scene he should immediately concern himself with the safe and strategic parking of his vehicle. He should quickly determine if it is necessary to park his vehicle to protect the accident scene and do so if required. If protective parking is not required, the patrolman should park his vehicle so as to create the least interference with the passing traffic. A minimum of 50 feet separation from the accident scene is recommended. Hazardous situations may warrant parking at a greater distance from the scene. At nighttime, the patrolman should position the patrol vehicle so that the headlights may illuminate the scene, but not blind passing motorists. Warning lights (dome, flashers, etc.) should continue to be deployed. Careless parking at the scene may encourage other official vehicles to do likewise and subject the patrol vehicle to the unnecessary risk of being struck by passing vehicles, thereby adding to the chaos already present.

The patrolman should immediately report his arrival at the scene to the dispatcher. Before leaving the vehicle and becoming involved in the ongoing situation, the patrolman should determine the need for and summon any emergency assistance not already present or on the way. The patrolman hereafter should be mindful of his own safety when leaving and entering his car. He should never turn his back to oncoming traffic and never stand between parked cars. He should be ever vigilant to take quick action if his safety is threatened.

ACCIDENT MANAGEMENT PROCEDURES, PART II
CONTROLLING THE SCENE

Considerations and Requirements

General. The patrolman at the scene of an accident may encounter a number of situations. There may be confusion, hysteria, injuries, fire, inclement weather, traffic congestion, poor visibility, indications or reports that the accident involved a hit and run vehicle, and many other situations or conditions with which he has to cope. The main objective for the patrolman, while controlling the scene, is to keep the accident from getting worse. The officer must be calm, flexible, make sound decisions quickly and see that they are carried out.

Steps for proper handling. Each accident is the result of a different set of circumstances. No two accidents are exactly the same; therefore, the patrolman's actions will vary with the situation. The urgency of any one of its aspects as well as the seriousness of the accident, will determine the course of action the patrolman will take. Caring for injured persons should generally be a first concern, especially if the injuries are serious. Arrangements for accident scene traffic control are of high priority, as well as preserving accident scene evidence until it is recorded or not needed. Instituting theft prevention measures is also a responsibility; however, it is considered secondary. Many of the patrolman's actions are accomplished almost simultaneously and without regard to a fixed sequence.

Determine need for additional outside assistance. The patrolman is in the best position to determine what assistance, if any, is required to bring the situation under control. After he has assessed the requirements, he summons additional assistance not already enroute, such as, ambulance service, fire fighting services, authorized tow/wrecker services for automobiles and/or heavy trucks, rescue squad, additional police as applicable, (e.g., supervisory personnel, patrolmen, accident investigation squad, rescue squad), medical examiner/coroner, special equipment, utility companies, etc.

Determine need for volunteer/bystander assistance. Depending on the seriousness of the accident, the patrolman may need to recruit volunteer/bystander assistance. With the proper guidance, volunteers/bystanders can perform such tasks as assisting with traffic control, placing warning devices, keeping people away from hazards, preserving evidence, assisting the injured, carrying messages, etc. The patrolman must give the volunteers specific instructions. Do not be vague. Let the individual know exactly what, where, and how to perform a specific task. Select responsible and easily identifiable persons such as truck, bus, or taxi drivers. However, the patrolman should discourage volunteer assistance if it is not required. The principals may be recruited and kept busy with various tasks until the patrolman has time to interview them.

Recognition of Potential Hazards

General. The patrolman responding to the scene must identify potential or existing hazards which might make the accident worse. The risk of fire is present in most vehicular accidents. Although fire seldom occurs the patrolman must be aware of this hazard as well as other hazards (e. g., trucks carrying dangerous cargo, fallen power lines, broken fire hydrants, icy road condition, etc.). Hazards have the potential of increasing the seriousness of the accident by further endangering life and property. The patrolman should be alert to recognize certain hazardous situations (such as widespread fire) where the probability of the patrolman's loss of life is greater than the probability of rescue.

Fire. The patrolman should take precautionary action to reduce a fire hazard. Initial action should include turning off the ignition and all lights on vehicles involved. Summon the fire department if a fire has started or if in the patrolman's opinion a fire may start. Fire may not erupt; however, the fire department is trained to neutralize the potential fire hazard. The following are dangerous conditions for which the fire department is normally summoned:

- Spillage of flammables from a passenger car or a tank truck loaded with flammables exists
- Accidents which caused extensive front end vehicular damage
- Vehicles which have turned over or rolled over on their sides
- In all cases where dangerous cargo is involved (e. g., explosives, flammables, etc.)

When summoning fire fighting assistance, it is important to tell the fire department what has been done and warn them of any additional hazards. In the case of injured personnel who are unable to leave vehicle on fire or the danger of fire and/or explosion exists, the patrolman must take immediate action to extricate the injured in the best and quickest way he knows. This may mean subjecting the individual to further injury. However, it is better to have a living injured person than a charred body.

Fire Handling Procedures

Types and uses of fire extinguishers. The carbon dioxide and dry powder type fire extinguishers are most commonly used by police. See Study Guide Exhibit 5-6 for detailed information on each type of extinguisher.

Fire-related precautionary measures. The patrolman must exercise precautionary measures to prevent fire-related injuries at the scene. Dependent on the situation, civilian personnel can help until the necessary assistance arrives at the scene. The patrolman should keep spectators away from the scene. Flares/fusees should be placed well away from the immediate area in situations involving flammable liquids and never be placed downgrade from the spillage. The patrolman should guard against smoking by spectators or cigarettes thrown by passing motorists and arrange for the warning of occupants of nearby buildings, especially if the accident happened at night when the danger of an explosion or widespread fire exists. Buildings within 500 feet in all directions should be vacated.

Specific fire control measures. The following are the fire control measures a patrolman should use for the specific situations:

- Tire fires. Sometimes a tire will start to burn after a vehicle has stopped, especially if heavy braking or skidding is involved. Trucks which are heavily loaded are most likely to have this problem. Water is the best extinguishing agent. However, in the absence of water or snow, shoveling dirt on the tire should control the flames or prevent ignition.

- Fire under the hood. Try to extinguish the flames by directing the extinguisher flow through the grill or underneath the vehicle. If this is not feasible or not effective, raise the hood slowly and attempt to extinguish the flames through the opening at the same time. Avoid raising the hood quickly since this would feed oxygen to the flames. If after expending the contents of the extinguisher, the fire is not completely out, attempt to smother the flames with sand or dirt.

- Fire inside the vehicle (upholstery, etc.). When possible, pull the seat cushions out of the vehicle and attempt to extinguish the flames. The upholstery should be saturated

Exhibit 5-6

Fire extinguishers

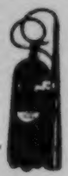
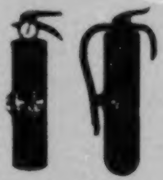
	Carbon Dioxide	Dry Powder
		
METHOD OF OPERATING	OPEN VALVE	RELEASE SAFETY LOCK PULL TRIGGER
HOW TO USE	Pull outlocking pin in handle. Hold horn in left hand and valve grip in right hand. Approach fire as close as possible and open valve, directing discharge at nearest edge of fire. Some models have wheel handle which turns to open valve.	Pull pin to release safety lock. Squeeze trigger valve on extinguisher or hose. On some types there is a separate device for puncturing gas cylinder. Hold extinguisher upright and aim nozzle at base of flame. Use sweeping motion on large area fire.
RANGE OF STREAM	15 lb. Size 6 to 8 Feet	8 to 12 Feet
KIND OF FIRES ON WHICH EXTINGUISHER IS MOST EFFECTIVE Note: None of these extinguishers are suitable for fires in metals such as magnesium, aluminum, sodium or fine steel turnings.	Best Use On Electrical equipment Flammable liquids Gasoline Oils and greases Paints, varnishes Solvents Can be used wherever smothering action is effective. Not particularly effective in high winds.	Best Use On Flammable liquids Gasoline Oils and greases Paints, varnishes Solvents Electrical equipment Can be Used On Textiles Wood Paper Rubbish
NATURE OF PRINCIPAL EXTINGUISHING AGENT	Carbon Dioxide gas produced when liquid is released from cylinder.	Dry chemical powder expelled by inert gas or air pressure.
PRINCIPAL EXTINGUISHING EFFECT	"SNUFFING" OR BLANKETING	BLANKETING
EFFECT OF FREEZING TEMPERATURES ON EXTINGUISHER CHARGES	Approximate climatic operating temperatures 120 degrees above to 40 degrees below zero.	Not subject to freezing.
HOW TO CHECK FOR FULL CHARGE	Check gauge reading periodically. Weigh extinguisher. Check weight with full charge marked on extinguisher.	All types: Check amount and condition of dry powder. Gas cylinder types: Check condition of cylinder outlet, weigh and check weight with that stamped on cylinder.

Exhibit 5-6 (Continued)

Fire extinguishers

	Carbon Dioxide	Dry Powder
How to Check for Full Charge (Continued)		Gauge types: Check gauge reading periodically and check total weight of unit against marked weight.
RECHARGING PERIOD	RECHARGE AFTER USE Extinguisher should be checked annually by weighing	RECHARGE AFTER USE Check condition of powder and gas cylinder annually.

with water to assure that the fire is completely out. Handle truck cargo the same way as the seat cushions and use the appropriate extinguishing agent.

- Clothing on fire. Do not permit the person(s) to run or move around since this would fan the flames. Place the person on the ground. Forcible restraint such as a football tackle may be necessary. Smother the flames with a blanket or other material that you might have available. If nothing is available, roll the victim over and over on the ground to smother flames. Once the flames are out and water is available, douse the victims clothing with water to insure all sparks are out. Apply first aid for burns and arrange for the transport of the victim to the hospital.

Control measures after the fire is out. The patrolman should protect the vehicle to prevent the fire from recurring, or until the fire department takes over. Do not allow vehicles to be started or removed until all hazards have been controlled. Vehicles that are to be towed should be inspected to insure that no part is dragging on the pavement which may create sparks and fire. If possible, move any burned part a safe distance from undamaged property. For example, have burned seats removed from the vehicle and laid aside. Continue to keep spectators away and prohibit smoking.

Recognition of Dangerous Cargo

General. Patrolmen responding to the scene of an accident involving a truck must be able to recognize the type of cargo the vehicle is transporting in order to evaluate the potential danger to life and property and to determine the appropriate action. Federal regulations and state laws stipulate that vehicles transporting potentially dangerous cargo be conspicuously marked and shipping containers labeled.

Classes of hazardous material. There are several classes of hazardous material. The patrolman should have an understanding of these materials, as well as be able to recognize them. The following is a brief description of each type class of hazardous material.

- Explosives. There are three classes of explosives: Class A, B and C.

  - Class A - detonating explosives of maximum hazard. Some examples are explosive ammunition of various types, solid high explosive, more than 1,000 blasting caps, etc.

  - Class B - function by rapid combustion rather than detonating. Primary hazard is fire. Some examples are special fireworks, flash powders, railway torpedoes, etc.

  - Class C - relatively safe explosives, such as common fireworks, highway fuses, small arms ammunition, etc.

- Flammable liquid. Any liquid which gives off flammable vapors. Some examples are gasoline, ether, alcohol, etc.

- Flammable solids. Solids, other than explosives, which are liable to cause fire through friction, through absorption of moisture, through spontaneous chemical changes, or as a result of retained heat from the manufacturing or processing of the commodity. Some examples are charcoal, phosphorous, motion picture film, etc.

- Oxidizing materials. Substances which will decompose readily when heated to yield oxygen and may react violently with other chemicals or combustible materials. Examples include chlorates, nitrates, certain peroxides, etc.

- Corrosive liquids. Liquids which will cause severe damage to living tissue and to freight by chemical action, or are liable to cause fire when in contact with organic matter or with certain chemicals. Some examples are sulfuric acid, hydrochloric acid, nitric acid, etc.

- Compressed gas. Any material in the container having an absolute pressure exceeding 40 p.s.i. at 70°F. or an absolute pressure exceeding 104 p.s.i. at 130°F.; or any liquid flammable material having a vapor pressure in excess of 40 p.s.i. absolute at 100°F. There are two types of compressed gases. The first is flammable compressed gas which offers the hazards of fire and explosion.

Some examples are acetylene, propane, hydrogen, etc. The second is non-flammable compressed gas which does not meet the explosion or fire tests prescribed by regulation but offers the least hazard of pressure against the container. Examples include oxygen, helium, sulfuric dioxide, etc.

- Poisons. There are three classes of poisons, Classes A, B and C. Class A are extremely dangerous poisonous gases or liquids of such a nature that a very small amount of the gas or vapor from the liquid when mixed with air, is dangerous to life. Some examples are lewisite, mustard gas, nitrogen peroxide, etc. Class B are poisonous liquids or solids including pastes or semi-liquids which are known to be so toxic to man as to afford a hazard to health, but to a lesser degree than Class A poisons. Examples include insecticides, arsenic, carbolic acid, etc. Class C are irritating substances in liquid or solid form which give off dangerous or intensely irritating fumes when exposed to air or upon contact with fire. Some examples are tear gas grenades, sylyl bromide, brombenzyl cyanide (liquid), etc.

- Radioactive materials. These are materials that spontaneously emit radiation capable of penetrating and severely damaging living tissue and undeveloped film. Radioactive materials are classified as I, II or III, depending on the radiation levels emitted or their reaction with other radioactive materials. Radioactive material classified as III offers the greatest hazards of radiation or interaction with other radioactive materials. Those classified as I offer the least. Those classified as II have a slightly higher level than I. Examples of radioactive materials are cobalt 60, iridium 192, gold 198, uranium 233, or substances containing such materials.

Placards and labels. A truck carrying hazardous materials must display placards on four sides of the vehicle, which best describe the class of hazardous material it is transporting. In addition, the shipping containers must be labeled in accordance with the regulations. The patrolman should be able to recognize the various placards and labels and thus identify the presence of hazardous materials. The lettering on the placards should be at least four inches high. The shipping container labels are diamond shaped and are four inches wide on each side. Exhibit 5-7 illustrates the various placards, as well as examples of shipping container labels. The following is a brief review of each type of placard and container shipping labels.

- Cargo Fire - Avoid Water placards are used in addition to the appropriate hazardous material placard to warn individuals attempting to extinguish a fire. The lettering is black on a white background.
- Dangerous placards are used when commodities requiring different placards are loaded on the same vehicle and have a combined weight of 1,000 or more pounds. The placard lettering is red on a white background.
- Explosive A or Explosive B placards have red lettering on a white background. Placards are not required for Explosive C. Container shipping labels are not required for explosives.
- Flammable placards are used for flammable solids or flammable liquids, or a combination of both. The placard lettering is red on a white background. The container shipping labels for flammable solids are black lettering on a yellow background and black lettering on a red background for flammable liquids.
- Flammable Gas placards are used for shipments of 1,000 or more pounds of flammable compressed gas. The placard lettering is red on a white background. The container shipping labels have black lettering on a red background.
- Compressed Gas placards are used for shipments of 1,000 or more pounds of non-flammable compressed gas. The placard lettering is green on a white background. The container shipping labels have black lettering on a green background.
- Corrosives placards are used for shipments of 1,000 or more pounds of corrosive materials. The placard lettering is blue on a white background. The container shipping labels have black lettering on a white background.

Exhibit 5-7

Dangerous substance placards and examples of shipping container labels

Dangerous Substance Placards

CARGO FIRE-AVOID WATER

FLAMMABLE GAS

EXPLOSIVES A

COMPRESSED GAS

EXPLOSIVES B

DANGEROUS

FLAMMABLE

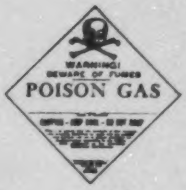
POISON

CORROSIVES

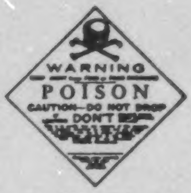
OXIDIZERS

RADIOACTIVE

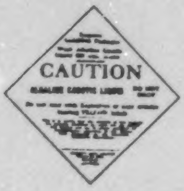
Examples of Shipping Container Labels

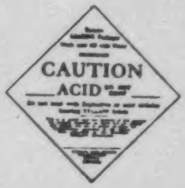

WARNING!
BEWARE OF FUMES
POISON GAS

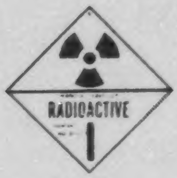
Class "A"

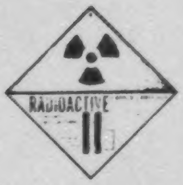

WARNING
POISON
CAUTION—DO NOT DROP
DON'T

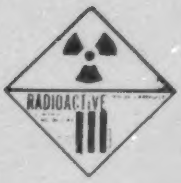
Class "B"




CAUTION
ACID


RADIOACTIVE
I


RADIOACTIVE
II


RADIOACTIVE
III

- Poison placards are used for any quantity of Poison Class A or a combination of Poison Class A and B, or if 1,000 pounds or more of Class B poison is transported. The placard lettering is blue on a white background. The container shipping labels have red lettering on a white background. Class C poisons do not require placards; however, they are labeled.

- Oxidizers placards are used for shipments of 1,000 or more pounds and have yellow lettering on a black background. The container shipping labels have black lettering on a yellow background.

- Radioactive placards are required on vehicles carrying radioactive material of the class III variety. The placard lettering is black on a yellow background. The container shipping labels for radioactive II and III materials have black lettering on a half white and yellow background with type "II" and "III" printed in red. Radioactive I material labels have black lettering on a white background.

Proposed hazard information system. The Department of Transportation, Office of Hazardous Materials, is currently developing a new system to aid police, fire, and other emergency response personnel in incidents involving hazardous material. The information system is called the hazardous information (HI) system. The HI system is designed to enable official personnel to quickly recognize and report the hazard, as well as determine the possible precautions and actions.

Basically, the proposed HI system requires that each shipping paper, label, and placard bear a hazard information two digit number. The first digit represents the hazard base. The second digit indicates the type of multiple hazards present. Thus, if only one hazard is present, the second digit would be a zero. Study Guide Exhibit 5-8 illustrates the proposed HI numbers, classification, and placards.

The Department of Transportation will publish a book which will contain approximately 75 hazardous information response cards. These cards will include all the regulated hazardous substances. The books will be distributed free of charge to all emergency response organizations. The hazardous information response cards will give information about the type of hazards present, the potential hazards present (fire, explosion, health, etc.) and immediate action information (specific

Exhibit 5-8

Proposed hazard classes, placards and HI numbers

HI Number	Classification	Placard
11	Explosive C	FLAMMABLE
15	Explosive B	EXPLOSIVES
17	Explosive A	EXPLOSIVES
20-21	Non-flammable Compressed Gas	COMPRESSED GAS
22-23	Flammable Compressed Gas	FLAMMABLE
24-28	Highly or Extremely Toxic Material (Gas)	POISON
30	Combustible Liquid	COMBUSTIBLE
30-39	Flammable Liquid	FLAMMABLE
40-49	Flammable Solid	FLAMMABLE
50-59	Oxidizing Material	OXIDIZER
60-69	Highly or Extremely Toxic Material	POISON
70-79	Radioactive Material	RADIOACTIVE
80-89	Corrosive Material	CORROSIVE

instructions regarding fire, spillage or leakage and first aid). It is proposed that the patrolman confronted with an incident involving hazardous material would simply look up the HI number in his book for guidance in effecting control measures.

Handling Procedures for Accidents Involving Dangerous Substances

General. Most dangerous substances require special knowledge in order to handle them. In the event of an accident, many trucks transporting dangerous substances carry special instructions for police, fire department and truck drivers, which describe handling procedures and first aid instructions for the injured. Normally, these instructions are in an envelope inside the cab of the truck. Where they are provided, the patrolman should follow them.

Procedures for protecting the scene. The patrolman must recognize the hazard in order to take appropriate action. There are no strict set of chronological steps for any accident scene and the patrolman's actions will depend on the most urgent matter at hand. A review of the actions of considerations which may be appropriate are listed below:

- Re-park the police vehicle, if necessary, in a location which is a safe distance from the hazard.
- Remove injured persons from danger as quickly as possible.
- Keep spectators away from the scene; however, do not hesitate to utilize civilian assistance until additional help arrives on the scene.
- Notify headquarters of the collision, type of vehicles and hazards involved. If warranted, request additional assistance.
- When high explosive or radioactive materials are involved, headquarters will notify the nearest military installation or the Atomic Energy Commission Office for special monitoring. If fire is involved, attempt to extinguish it only if it has not reached the cargo area of the vehicle. Stay out of the smoke as much as possible and follow the advice of the special monitoring team once they have arrived at the scene. If the team

has not arrived and there has been a fire involving radioactive material, segregate all individuals who may have been contaminated and wait the arrival of the team. Do not permit anyone to enter the scene until it is safe to do so. Do not attempt to clean up the scene until it is approved by the special monitoring team. In addition, consideration should be given to rerouting traffic and/or evacuation of homes in the affected area.

Electrical hazards. Vehicular accidents involving electrical power lines are dangerous to life and property since the hazards of electric shock and fire are present. A review of the precautionary measures are listed below.

. Contact the power company and request immediate shutdown of power. Advise the power company of the exact location of the accident, including the pole identification number.

. Keep spectators at least 100 feet from the scene of the downed wires.

. Consider advising the occupants, if they are inside the vehicle and not seriously injured, to remain inside until the power company can shut the power off.

. In the event of serious injury, where death may be imminent unless rescue is immediately effected and there may be a delay in power shutdown, an attempt should be made to remove the wires. Two methods may be employed in removing the electrical wires; however, both involve extreme risk of electrical shock. The wire may be removed by using a very dry rope which has been stored in a dry area for some time or by using a very dry wooden pole which has been stored in a dry area for some time. However, these acts should not be considered routine but a last resort if power shutdown may be delayed. Downed/cracked utility poles present the same hazards as downed wires and the same safety precautions should be employed.

Other hazards. There are many other hazards that may contribute to degrading the accident scene, e.g., water from a broken fire hydrant, spilled substances either liquids or solids, obstructive debris. The patrolman at the scene must determine and summon the necessary aid to neutralize the hazard.

Care and Handling of the Injured

General. A responsibility of a patrolman controlling the scene is to see that the injured are cared for until professional medical assistance is available. The patrolman is not expected to treat injuries; rather, he applies first aid measures which may save lives and keep injuries from intensifying until competent medical assistance arrives at the scene. If not immediately evident, inquire whether there are any injured persons. Victims may have gotten out of the vehicles; they may have been thrown from the vehicle into weeds, bushes, etc.; they may have walked for aid and collapsed. Summon the required assistance, i.e., ambulances, helicopter, doctors, if not already en route.

Emergency first aid. The patrolman should evaluate the injured person's condition in order to apply effective first aid measures. Usually, the injuries incurred are of such a serious nature that they require expert medical attention or they are relatively minor and can wait for treatment. However, some serious injuries require immediate first aid to prevent serious complications or a fatality. The principle life saving first aid steps are to stop the bleeding, restore breathing or clear the airways, and treat for shock. Injuries that require prompt action are reviewed below.

- Severe bleeding, such as arterial bleeding, can result in death. The patrolman should be aware of the various pressure points to control the bleeding.

- Shock is the depressed state of all body functions due to a failure of the circulation. Shock may cause death, even when the injuries are relatively minor. Since shock is easier to prevent than cure, treatment should be started before symptoms develop. Rough or improper treatment should be avoided since it can worsen the victim's condition and cause shock.

- Compound fractures result when a bone breaks through the surface of the skin and is exposed. They can result from improper handling of a simple fracture.

- Spinal and neck fractures are considered to be the most dangerous injury to persons. They are most common in serious accidents. The inability to move fingers, hands, toes and feet are symptoms of this type of injury. A general paralysis or the deformation of posture may be further indications of spinal or neck fractures. Extreme care must be taken in moving the victim.

- Asphyxiation or suffocation rarely occurs in traffic accidents; however, it can happen. This condition results from the lack of oxygen. The major symptom is the lack of breath and unconsciousness. The causes may be one of several, e.g., carbon monoxide poisoning, drowning, stomach squeezed against the steering wheel, a severe blow in the stomach, chest, back of the neck or certain areas in the back, electrocution, etc.

Immediate threats to injured persons. The patrolman must determine if there are any immediate or potential threats which may endanger the injured. Such threats as fire, oncoming traffic, exposure, etc., may require that the injured person be moved to a safe location until medical help arrives. If possible, certain types of injuries should be treated before moving the person, especially those injuries involving arterial bleeding and extreme shock. Injuries such as fractures of the neck, head, ribs and spine require extreme care in moving. Moving the victim may result in additional injuries. However, when he is lying in the face of danger, it is better to move him rather than risk a fatality.

Make use of the best help available until professional medical assistance arrives at the scene. Most people have compassion for the injured and will volunteer assistance. However, legally, the ordinary bystander is not compelled to assist an injured person. When possible, avoid enlisting help from passengers or excited bystanders, since they are emotionally aroused and therefore may inadvertently cause further injuries to the victim.

Removal/extrication procedures. As a result of an accident, persons may be trapped by the vehicle(s). Some examples would be: vehicles that have rolled over and the victim is pinned underneath, vehicles that are badly crushed and have pinned persons inside. When fire or oncoming traffic poses a threat, immediate action must be taken to remove/extricate the victim. Some related considerations are reviewed below:

- Use whatever tools are available such as a jack handle, pinch bar, or a wrench to pry open a door to get at the person. Accessibility often depends upon the position of the person inside the vehicle. When time permits, first aid should be given to a seriously injured person prior to moving him.
- Six or seven men can normally lift a car enough to remove a person trapped under it. However, a tow truck or a strong jack is required to lift a truck.
- When doors are jammed and an effort to pry them open fails, break the window and clear the glass before going in after the injured.
- If a car is lying on its side, entry may be gained by prying open the trunk and cutting or battering through the rear seat.
- Professional help may be required in removing persons pinned in or under a vehicle and should be summoned at the first opportunity. Fire departments have useful equipment and training in removing trapped persons. Rescue squads, associated with either police or fire departments, have specific equipment and training to handle most situations. Tow trucks can also be useful in freeing trapped persons. Make the **people** as comfortable as possible until they can be extricated.

Protecting the injured. The patrolman should move the injured to a protected area, to await the ambulance, unless they are so seriously injured that further injuries may result. Move the **people** to the side of a vehicle away from the road or on a side away from approaching traffic. If the weather is inclement or a long wait is expected, move the **people** under cover, e. g., a nearby building. The location should afford easy access by an ambulance and doctor. However, if they are in no immediate danger and they can be made relatively comfortable, do not move them.

Record the injured's destination. Once the ambulance or doctor has arrived and assumed the responsibility of the injured, the patrolman should record the destination of the injured, i. e., hospital or doctor's office, as well as record the name and address of the injured person. A follow-up investigation may be necessary for a number of reasons.

It may be necessary to determine the true extent of injuries. If the injuries are critical, the police need to learn if the person died in order to determine what legal action is to be taken. The character of trial proceedings resulting from the accident will depend on whether the injured lived or died.

Notification. The identity of the injured is needed to notify certain persons of the accident, especially if a fatality is involved. The patrolman may not personally notify the individuals, however, he should be sure it will be done. Individuals normally notified are relatives of the injured, the owner of the vehicle if he is not present, and the employers of bus, truck, and cab drivers.

Accidents involving a fatality. Usually a fatality can be determined by the nature of the injuries, e. g., a person's head may be crushed or he may be decapitated or disemboweled. However, death may not always be evident. The patrolman should not assume that a person is dead until he has checked for some of the more important signs of life, listed below:

- Heartbeat or pulse; the best places to feel for the pulse are the neck - on either side of the Adam's apple, and just below the wrist. Pulse is often difficult to locate due to the physical make-up of the people and their condition.
- Pupillary response; the pupils of the eye contract or become smaller in diameter when a light is flashed in the eyes. If the person were dead, the pupils ordinarily would not respond to a flash of light.
- Breath; a cool mirror, piece of glass, or plated metal becomes cloudy from the breath as a result of being held closely to the mouth or nostrils. There will be no moisture apparent if the person is dead or the mirror or glass is as warm as the body.
- If the patrolman has any doubt about a victim being deceased, he should continue to render first aid and care for the victim until competent medical assistance arrives at the scene.

Traffic and Crowd Control

General. Traffic and crowd control at the scene of an accident is one of the high priority aspects of accident management. Negligence or mishandling of any of these aspects may result in additional accidents due to congestion and confusion. Bystanders may be hurt. Traffic may destroy valuable evidence which may have helped in reconstructing the accident, as well as substantiating charges of law violations. The manner in which the patrolman conducts traffic and crowd control may affect the number of witnesses that will volunteer information; courtesy and firm direction should be a concern. The patrolman should assess the need for additional assistance required to maintain traffic and crowd control. Normally, the patrolman can handle the situation alone; however, accidents which completely block the roadway will usually require additional manpower to facilitate traffic and crowd control. Utilize competent civilians (truck drivers, service personnel) when the situation demands immediate help to warn and control traffic and bystanders until professional assistance arrives.

Warning devices. The patrolman must know exactly what kind of equipment the patrol car is equipped with in order to make utmost use of it as well as replenishing expended supplies. It is too late at the scene of an accident to discover that the supplies of flares are expended. There are several types of warning devices which are used to warn approaching traffic.

- Daylight warning devices. Traffic approaching the accident scene may be warned by using traffic cones, flags, relectors, flares/fusees and/or people directing traffic.

- Nighttime warning devices. Some form of lighting is necessary to warn approaching traffic during periods of low visibility or darkness. Flares/fusees, torches, automobile headlights, flashlights, lighted batons are examples of nighttime warning devices. Flares/fusees are the most common warning devices used during periods of darkness.

- Patrol vehicle devices. The flasher and dome lights should be activated, regardless of the time of day.

Placement of the warning devices. Warning devices, such as flares/fusees, cones, reflectors, etc., are designed to alert approaching traffic of an impending hazard or adverse road condition, as well as to safely channel traffic past the situation. Although most warning devices are highly visible from a distance, experience has shown that a large number of motorists do not reduce their speed or merge into a safer traffic lane until they are close to the warning device. Therefore, the patrolman must place the devices to permit the motorist to perceive and properly respond to the conditions within a margin of safety. Speeds of vehicles, traffic volume, stopping distance, lane obstruction, and the location of the accident are some of the factors to consider in placing the devices. Study Guide Exhibit 5-9 illustrates the general placement of warning devices in conjunction with the following examples.

- A car traveling at 30 mph on dry pavement will require approximately 80 feet of stopping distance. Therefore, for such a situation, the patrolman should place the first warning device a minimum of 100 feet from the scene to provide for an adequate margin of safety.

- A car traveling 60 mph will require approximately 180 feet of stopping distance. Therefore, the patrolman should place the first flare a minimum of 200 feet from the scene.

The need for additional warning devices must be considered when an accident occurs on a hill, curve, or where visibility is limited. Furthermore, warning devices may be required in opposing traffic lanes when the accident interferes with such traffic flow. Placing the devices while approaching the scene will save the patrolman from back-tracking. Care must be exercised so that the patrol car is not creating a hazard to traffic while flares are being placed.

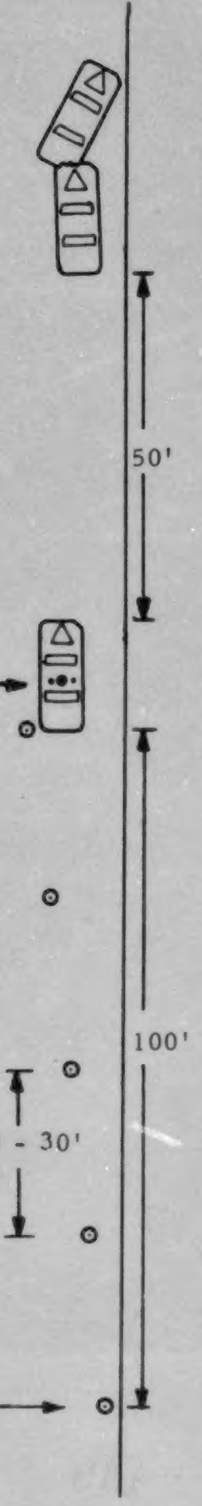
Safety precautions must be initiated while handling flares/fusees since improper or careless handling can result in serious burns. The proper handling procedure is explained below.

- Grasp the flare in one hand near the base. Pull the black tape up and across the cap to expose the striking surface with the other hand. Next, twist off the cap to remove it and expose the point of ignition. Position yourself with the wind at your back before igniting the fusee. This prevents the toxic smoke and sparks from being blown toward you.

- Extend both arms in front of you. Hold the flare in one hand, while in the other hold the cap against the top of the flare. Ignite the device by moving the flare in a

Exhibit 5-9

General placement of warning devices



Minimum distance between patrol car and accident vehicles

Emergency warning lights activated

Warning and channeling distance required for traffic traveling at 30 mph.

Warning device spacing interval depending upon conditions

Note: Refer to the Study Guide text for additional procedures

Placed first, removed last

motion away from the body and against the cap surface. Hold the flare at arms length after it has ignited and lower it to the ground. Place it on the pavement or on the side of the roadway with the burning end facing the traffic to be warned. Do not throw a burning flare to the ground. You may be struck and injured by small pieces of burning phosphorous that are forced loose by the impact of the fall.

- A flare should not be placed upright but at a slight angle. Standing a **fusee** or flare upright may present a hazard in a heavy rainstorm. Rain drops falling on the burning end may cause tiny bits of burning phosphorous to be propelled as much as 20 feet. Burning flares are removed from the roadway when they have served their purpose. Do not kick a burning flare aside. Instead, use a stick or other implement to roll it to the side of the roadway. Once the flare has been moved either to the curb or on the shoulder of the roadway, it may be extinguished by grasping it by the base and forcing the burning end into the ground or into the point where the curb meets the street surface.

Considerations for maintaining a traffic flow. Placing warning devices does reduce the chance of additional accidents occurring; however, the devices must be supplemented by active traffic direction and control in order to maintain the most efficient flow. In the event of a complete road blockage or severe congestion, the patrolman should consider a temporary detour route. The patrolman will need assistance to establish blockades at the detour points. The detour must:

- Accommodate the traffic in terms of weight, height and volume requirements
- Be adequately marked to prevent drivers from becoming lost
- Facilitate emergency vehicles approaching and leaving the scene
- Be a convenient route for a majority of traffic

When one or more traffic lanes permit traffic past the accident scene, traffic control must be maintained in all lanes, including opposing traffic lanes, to prevent "gaper's block" and additional accidents. Once the patrolman has turned over the responsibility of caring for the injured to competent medical aid, his primary effort should be devoted to maintaining traffic and crowd control until the scene is cleared.

Parking by curious drivers. Curious drivers who park their vehicles near the scene can hamper traffic flow as well as hinder the operation of emergency vehicles. Active traffic direction and control can prevent the overly curious driver from stopping. Inform drivers to keep moving and that stopping is not permitted.

Pedestrians and bystanders. The patrolman must keep spectators away from the immediate area of the accident since they will hinder the emergency response personnel and equipment. He should not let bystanders move or treat the injured unless the patrolman is convinced they are qualified. The patrolman must be courteous but commanding in handling pedestrians or bystanders. He should shout only as a last resort. Bystanders should be restricted to any available sidewalk. If a crowd should form and one person tries to get closer to the scene, all will attempt to follow suit.

Preserving Physical Evidence

The preservation of accident-related evidence may not be necessary for a minor accident. Probably the most important factor to consider is clearing the roadway. However, in most serious accidents, preserving accident evidence, such as debris and skidmarks, is very important. The patrolman should protect them until they are recorded or not needed as further evidence. Short-lived evidence, such as debris denoting the collision point, tire prints, skidmarks, radiator or crankcase run-off, blood stains, must be protected from traffic and bystanders until it has been recorded and/or photographed. If evidence must be moved or obliterated prior to recording it, the exact position of the item should be marked for later measurement and recording.

The patrolman may have to consider temporarily holding up traffic to protect the evidence until it has been recorded. In situations where traffic lanes are open, some evidence may be in jeopardy of being removed or destroyed. The patrolman may have to guide the traffic around the evidence by using signals and gestures and/or placement of warning devices.

Moving Damaged Vehicles in Emergencies

General. Damaged vehicles may be moved in emergencies to prevent further damage to life and property. When such conditions exist the patrolman can have the vehicle moved or impounded. Normally, the owner of the vehicle, if capable, is responsible for removing the vehicle. The patrolman may ask him if he knows or prefers a specific wrecker service and if the person does not prefer a specific service, the patrolman can summon the necessary aid. However, in emergency situations or when no responsible person for the vehicle is available, the patrolman can arrange to have the vehicle moved or impounded. Some situations requiring prompt movement of a damaged vehicle are listed below:

- A person is trapped in a vehicle near fire or spilled flammables and cannot be extricated easily.
- A wrecked vehicle is situated on a blind curve, crest of a hill, or in a fog pocket and presents an immediate hazard to oncoming traffic.
- A vehicle is causing extreme congestion.
- A disabled vehicle is located on or near a heavily traveled limited access highway.

Moving the vehicle. The best method to move a wrecked vehicle is with the aid of a professional towing service. However, in emergency situations, a tow truck may not be immediately available and the patrolman must use the best means available. This may involve driving the vehicle, shoving or pushing it off the roadway with volunteer assistance. Move the vehicle only enough to reduce the emergency. This may mean lifting a vehicle just enough to remove a pinned individual or moving it out of the way of oncoming traffic.

Precautions in moving vehicles. The patrolman should prevent unnecessary damage to other vehicles. Injuries may result from careless handling of vehicles. Insure that the vehicle is moved completely off the traveled portion of the roadway to minimize additional collisions. In addition, the position of all four wheels or four corners of the vehicle after impact should be quickly marked prior to moving the vehicle. This will enable the patrolman to complete any measurements of final resting place at a later time.

Theft Prevention Measures

General. Protecting property is a primary police responsibility. The patrolman has a moral obligation to protect the property of individuals involved in an accident. However, if the owner of the vehicle or a responsible representative is able to look after his property, especially personal belongings, then the responsibility is primarily his. Minor accidents normally do not require theft prevention measures, since the persons involved are able to take care of their own property. The patrolman is more apt to apply theft prevention measures in serious accidents involving injured persons and/or scattered personal property or truck cargo. Theft prevention measures have a high priority. However, they are secondary to fire prevention, care of the injured and traffic and crowd control, although they can be applied concurrently with other responsibilities.

Items likely to be stolen. Often items are taken by bystanders or curious drivers at the scene. These individuals did not plan to steal anything; however, the temptation is there because they see something they like and want. Some of the items commonly taken at the scene of an accident are reviewed below.

- From truck cargoes: clothing, food, beverages, cigarettes, small machines such as typewriters, small articles of furniture such as lamps.
- From passenger vehicles: luggage, tools, cameras, fishing tackle, golf clubs, brief cases, clothing.
- Equipment from vehicles: accessories which are easily removed, such as radiator ornaments, dual exhaust pipes, hub caps or rims, radios, spare tires, tools, mirrors, seat cushions, spot or fog lights.
- From injured or dead persons: wallets and purses, money, jewelry, clothes.

Situations when theft is likely to occur. Situations which are conducive to theft include:

- Insufficient responsible personnel are present at the scene to handle all the emergencies as well as guard against theft.

- Large crowds of spectators may have formed and there is a great deal of confusion.

- The patrolman may not have reached the scene and the vehicles are unattended or the persons are unable to guard their property.

- The individuals involved are tourists and have many tempting personal belongings (e.g., cameras, sporting equipment, etc.).

- Truck cargo is scattered over the roadway.

- Low visibility and/or darkness

Theft prevention measures. The best way to prevent theft is by removing the temptation to steal. Several theft prevention measures can be applied , such as:

- Keep spectators away from the immediate scene.

- Remove ignition keys from automobiles, pick up any personal belongings, and store them inside the vehicle. If possible, lock the glove compartment, car doors and trunk.

- Spilled solids from trucks should be gathered into a central area and guarded. If possible, the contents should be stored in the truck's cargo area. If the truck driver is able, he should be encouraged to guard his own vehicle. The patrolman should arrange to notify the truck driver's company or authorized insurance agency of the accident as soon as possible, and arrange for transfer of the cargo and evacuation of the vehicle.

- The patrolman should properly identify any property taken into custody to avoid charges of negligence in the handling of the property.

ACCIDENT MANAGEMENT PROCEDURES, PART III
OBTAINING INFORMATION FROM PEOPLE

General Considerations

Once the urgent matters related to the preservation and protection of life, property and evidence at the scene have been attended to, the patrolman should immediately turn his attention and efforts to the identification and documentation of the facts surrounding the accident. The major sources for accident related information are the three major components of the highway transportation system: the human element (the drivers, passengers, and witnesses), the vehicles, and the trafficway. The order in which the patrolman should access these sources of information is not necessarily a fixed order. The patrolman must consider each individual accident situation to determine the priority for obtaining certain information. For example, if the accident occurs in a heavily traveled, limited access highway or city street, the patrolman may have to defer any extensive interrogation of drivers, passengers and witnesses to a later time and better location. He would need to be concerned with expeditious examination of the roadway, and the vehicles before they are towed away. If debris and roadmarks are subject to being destroyed by weather and uncontrollable traffic conditions, this form of information should be observed and documented before extensive interviewing of the principals or observation of vehicular condition. If injured parties are to be transported from the scene, or inclement weather is likely to force valuable witnesses to retreat from the scene, the human element may need to be accessed before anything else.

Effects of Driver and Pedestrian Condition

General remarks. Many of the conditions, states or attributes of the driver and pedestrian which affect traffic behavior have already been discussed in the unit on Traffic Law Enforcement. Those of particular relevance to the accident situation will be briefly reviewed. In considering human condition factors, the patrolman should keep in mind that nearly always some form of human condition is a contributing factor in an accident. However, because some form of human impairment is detected, it does not necessarily follow that the condition was a contributing factor. The following questions should always be asked: "Would the accident have happened if this condition had not been present? "; "Did this condition cause an operational factor or behavior which contributed to the accident? "

Visual impairments. Deficient acuity (sharpness of vision) might be suspected as a cause if the accident involved a traffic sign at some distance with small lettering, or the driver says he did not notice or understand a sign. Night blindness (inability to see adequately at night) could be a factor if a driver is over 50 years of age and a dark object (pedestrian or car) was struck, or a vehicle is off the pavement or shoulder, or the driver states he did not see the object struck. Glare could be a possible contributing factor if the vehicle ran off the road, or there was a collision with a pedestrian, fixed object, animal, or slow vehicle. Tunnel vision (restricted side or peripheral vision) could be suspected if there was a right angle collision during the daytime, when the car on a cross street was moving rapidly. Impaired depth perception could be involved if there was a collision during close quarter maneuvers, such as those performed in parking, or a sideswipe occurred during the daytime on a narrow roadway. Color blindness might be suspected if a driver runs a red light and insists it was green, or identifies a green or red object as some other color.

Hearing impairments. A hearing impairment is not very often a contributing factor, but the patrolman should suspect a hearing deficiency if information indicates that a driver or pedestrian did not slow down or yield the right-of-way to someone who sounded a horn, or a driver apparently ignored a train whistle.

Knowledge deficiencies. In some cases, a driver or pedestrian may be suspected of having deficient knowledge in one or more of the following areas:

- Traffic laws especially "rules of the road"
- Required evasive action

Skill deficiencies. The driver may know what action is required in avoiding a hazardous accident producing situation but lacks the skills to accomplish the action. Activities where skill deficiencies are frequently found are listed below:

- Recognizing and reacting in a timely fashion to a hazardous traffic situation

- Physical control of the vehicle

- Recognizing the need to "share" the road with others (drive defensively) and responding accordingly

- Being vigilant and resisting distractions (e.g., such distractions as something striking the car; inside distraction caused by passenger, radio, pet; looking at map, lighting a cigarette; outside perception as well as an unusual roadside event; day dreaming, etc.)

Situations where lack of skill may be suspected are:

- A novice driver was involved with less than 6 months or 1,000 miles driving experience
- Driver was driving an unfamiliar vehicle
- Driver had not operated a vehicle for a year or more
- Driver was unaccustomed to heavy traffic

Motives/personality. It has already been discussed how these factors can negatively affect traffic performance (e.g., strong emotions such as fear, anger, characteristics such as exhibitionism, timidity, etc.).

Physical states. There are many induced physical states which can impair behavior and thereby contribute to an accident. Some of the more important sources of physical impairment are:

- Medicines and drugs
    - Prescription and non-prescription drugs which are abused
    - Alcohol
    - Suspect either or both of the above when the typical symptoms are present
- Poisons
    - Ever present danger associated with vehicular operation is carbon monoxide (CO) poisoning from engine exhaust
    - It can be the result of the following situations:

    - -- Faulty exhaust system
    - -- Vehicle standing with engine running in stalled traffic, in cold weather, with the heating system running
    - -- In rare instances, chain smoking of cigarettes
  - Suspect CO poisoning when the driver complains of dizziness, headache, weakness and shows dilated pupils, and may have been exposed to the previous situations

- Fatigue
  - This factor can be suspected if the typical symptoms are observable or the condition is offered as a cause when:
    - -- Accident has occurred after driver's normal bedtime
    - -- Driver worked unusually long hours before driving
    - -- Operator had been driving steadily for 10 or more hours

- Illness
  - Many illnesses can impair traffic performance but common among them are:
    - -- Heart ailments
    - -- Epilepsy
    - -- Diabetes
    - -- Mental illness

Interviewing Drivers, Witnesses and Passengers

General procedure. One of the early priorities, once the emergency is under control, is to identify the drivers, passengers, and witnesses and to find out just what happened. In general, the following procedures should be followed in regard to handling the people at the scene.

- Identify the drivers. Drivers often are anxious to identify themselves. If drivers do not identify themselves, the patrolman will have to ask likely looking candidates if they are the drivers. If a driver cannot be found, initiate procedures for a "hit and run" accident. The patrolman should be sure that a driver is not temporarily away from the scene, (e. g. , taken to medical attention or has parked his car in or retired to a safe place remote to the accident scene).

- Ask for driver licenses and vehicle registrations. Retain these documents until the investigation is complete. If a permit is not available, ask for and retain alternate forms of identification.

- Verify information on operator's permit and registration. This is done by asking the operator questions about his name, date of birth, address, make, year and model of car, and asking him to sign his name on a piece of paper.

- Evaluate driver behavior for signs of impairment (alcoholic/drug influence, illness, fatigue, etc.).

- Interview each driver separately and obtain his account of what happened.

- Interview passengers and witnesses as soon as possible to have a basis for evaluating drivers' accounts; avoid processing witnesses with obvious biases and prejudices or sensory impairments (visual, hearing deficiencies).

- Evaluate all accounts of accident events against the physical conditions present at the accident scene.

Considerations for conducting interviews. There are several points that the patrolman should keep in mind when conducting interviews at the scene of an accident. He should be objective and impartial. The patrolman should avoid letting any attitudes that he might have about a person's race, religion, personality, or present predicament arouse his emotions.

When a patrolman becomes emotionally involved, he loses his ability to obtain information in a logical and unbiased manner.

He should use a positive approach in phrasing questions and not start off by saying, "I suppose you don't know anything about this," but use an approach like "please tell me just what you did or saw."

The patrolman should be clear and specific in phrasing questions, and critical of forthcoming answers. Instead of asking a driver, "where were you going?", ask "in which direction were you traveling?" The patrolman should have people show where they were when something happened, or in which direction they were traveling. He should not accept vague or general descriptions; have people estimate quantities such as "X feet" or "X miles an hour."

Ask pointed, but not leading questions; never suggest answers to questions. If a specific response is not forthcoming, an attempt should not be made to force one; the chances are if a reasonable answer is suggested, the individual will agree to it. Rephrasing the question may elicit an answer.

The patrolman should take measures to prevent conflicts from arising between principals. He should keep drivers and witnesses separated until each has had a chance to give an individual account, and use tact and diplomacy to stifle any emotional outbursts.

He should plan a basic approach to questioning, but not follow a strict routine of questioning. If an answer to a question is of particular interest, it may be worthwhile to postpone the next planned question and explore the answer just received.

The patrolman should not antagonize or badger an injured or confused person--it will not help to get the facts.

Where possible, he should attempt to verify accounts of what happened by comparing driver statements with witnesses and passengers. Moreover, verbal descriptions should be compared with the physical conditions (e.g., statement of speed against length of skidmark or damage to vehicle, stated position on road against location of roadmarks, etc.).

Behavior often encountered when interviewing people. Some people may be injured or in such a state of anger or anxiety as to make interviewing at the time unprofitable. In such a case, time should be allowed to pass for the individual to regain control of himself.

People don't often intentionally lie about the reasons or causes of an accident, but frequently create "excuses" (the process of rationalization) which they feel relieve them of the blame for an accident. This may involve the fabrication of an incident or situation which made them do what they did.

Retrograde shock amnesia can cause a temporary loss of memory, back in time, which can be resultant from a blow on the head or severe loss of blood. The loss of memory can be from a few minutes to several days. This could account for a person really not remembering "what happened."

Some people cannot provide useful information simply because they have failed to perceive anything significant about the accident. People who think they saw an accident happen, often have had their attention drawn to the accident by the sounds of collision--they really did not see the accident happen. Some people naturally tend to notice things that others do not. For instance, women tend to note forms of wearing apparel and personal effects. Young men often notice and recall with exceptional accuracy, the year, make and model of cars.

Factors affecting when and where interviews should take place. It is desirable to interview persons near the location they originally witnessed accident events, to aid in their recall. As mentioned before, the location of the accident may preclude extensive interviewing at the scene. If the accident occurred on a heavily traveled limited access highway or city street, there is a great urgency to clear the roadway of vehicles and debris. Extensive interviewing should be conducted at the nearest convenient location out of harm's way (e.g., lesser traveled side street, or exit off a limited access highway). Before leaving the scene, however, the patrolman should at least identify the drivers, take their licenses and registrations and get a brief account of what happened while the facts are still fresh in the minds of the principals. The need to document or collect physical evidence may delay further interviewing (e.g., broken auto parts, identification and measurement of roadmarks that may soon be obliterated). If a delay in interviewing drivers or witnesses is unavoidable, the patrolman should consider giving these individuals something useful to do such as preparing a written account or diagram of the accident.

Information to be obtained from drivers. Most information necessary for filling out the accident report form can be found from observations of the physical conditions at the scene, and the inspection of the operator's license and vehicle registration forms. To discover the facts related to how and why the accident occurred the patrolman will need to question the drivers in depth. A suggested but not necessarily exhaustive list of questions that may be asked of drivers is:

- Where were you when you saw the (car, pedestrian, fixed object, etc.)?
  - This will establish the first point and time of awareness.
- What were you doing at the moment you first saw the (car, pedestrian, object)?
  - Look for statements as to speed--speed changes, direction of movement, where his attention was directed.
- Where were you when you first realized you were in trouble?
  - This will help to establish the point of perception.
- Exactly what did you do to avoid the accident?
  - This will uncover any evasive action taken by the individual.
- What happened next?
  - At this point the driver should describe the key event.
- Exactly where did the collision (or other key event) take place?
  - It is not necessary to ask this question if the answer can be determined from the physical evidence.
- Where did you stop after the collision (or other key event)?
  - Again, it will not be necessary to ask this question if this can be determined from the position of the vehicles.
- What is the first thing you remember after the accident?

- What is the last thing you remember clearly before the accident?
  - This is especially useful for determining the extent of any shock amnesia, if the driver was unconscious for any period of time.
- Who did you first see after the accident, and what did you say to this person?
  - This could identify witnesses at the scene, and uncover any accounts of the accident the driver might have given immediately after it occurred.

In addition to the above questions, the patrolman should ask questions in the following areas:

- Driver condition
  - Was he sick, taking medication, had he been drinking; was he bored, fatigued, nervous?
  - Did he know the meaning of traffic control devices in the area?
- Trip plan
  - Was he late for an appointment or otherwise in a hurry?
- Vehicle condition
  - Was the vehicle properly maintained, the tires, steering, brakes in good working order?

Information to be obtained from witnesses. The patrolman should locate witnesses as soon as possible after getting to the scene. It is desirable to note and record the license plates of vehicles parked near the scene as these vehicles may belong to potentially valuable witnesses. It may be necessary to contact witnesses before the drivers, since the law does not compel them to remain, they may leave the scene. The name, address, and vehicle license no. of any witness should be obtained for later contact, if an interview at the time is not feasible. If it is necessary to call for witnesses, the word "witness" should never be used, as this may alarm people. Questions like "can anyone give me any information about this accident? " or "this person is hurt--there is a lot of damage here, can anyone provide any information on how this happened? " are effective. The patrolman should always be alert for biased witnesses with vested interests in or alliances with the driver. Some questions that can be posed to witnesses are:

- What did you see or hear?
- Where were you when the accident happened?
  - The patrolman should verify that the witness's view of the accident was not blocked in any way.
- What were you doing when the accident occurred?
- Where were you going at the time?
- Where were you looking when the accident happened?
- What is the condition of your vision and hearing?

At times, prompt and precise answers from witnesses may not be forthcoming. The witnesses should be allowed time to remember.

Information to be obtained from passengers. The patrolman should question all passengers as they may have valuable information due to their strategic location in the vehicle. Names and addresses of passengers should be obtained at the outset. They are not obliged to remain at the scene, but will generally stay with the driver until he is dismissed. The relationship of passengers to the driver should be determined, to uncover any potential bias. The patrolman should question passengers separately from the drivers and compare the stories. Questions that may be asked of passengers are:

- Where were you sitting?
- What were you doing at the time of the accident?
- Where was the car when you were first aware that you were in trouble?
- What did the driver do before the accident?

Compulsion to provide information. The patrolman should be patient with those individuals who do not give more than the required information at the scene. He should not intimidate these people who give minimal information, but note this fact in his reports. Some fleet truck drivers are under explicit instructions from the owners or their insurance company to divulge only essential information at the scene of an accident.

Written statements. Written statements or accounts of what happened should be taken from drivers, passengers and witnesses wherever possible. If a driver or witness cannot be interviewed early, he should be asked to write down on a blank piece of paper just what happened - what he saw, heard and did - and to sign his name, write down his address, occupation and the date. When the urgent matters are controlled, the officer then can review the statements and interview the individuals to clarify and expand upon the statements. This procedure will allow for information to be obtained from witnesses who will leave the scene before the patrolman has time to interview them.

Pedestrian accidents. The patrolman should closely examine the body and clothing of any pedestrian struck by a motor vehicle, being careful to note the following things to match up with any vehicle (s) involved in the accident:

- Location of any injuries (loss of blood, skin or hair)
- Location of and type of clothing damaged

ACCIDENT MANAGEMENT PROCEDURES, PART IV
OBTAINING INFORMATION FROM THE VEHICLE

How the Vehicle Can Contribute to an Accident

Vehicular condition can contribute to an accident in a number of ways. When some part of the vehicle's structure, equipment, accessories, or load interferes with the safe and normal operation of the vehicle, vehicular condition is a contributing factor. It is always necessary to distinguish between pre-accident vehicular condition as a contributing factor versus pre- or post-accident vehicular condition as a circumstance. Vehicular condition can be, but is infrequently the primary contributing factor or cause of an accident. The patrolman should, therefore, check closely for factors being contributed by the human element or trafficway, even when none are apparent. If the patrolman can find more than one reason for suspecting vehicular condition as a contributor, then he may be reasonably confident that vehicular condition is at least partly to blame for the accident. The circumstances of the accident often suggest certain defective vehicular conditions, e. g.:

- Sideswipe from an opposite direction at night could be due to a failed headlight on one vehicle.
- A slowly moving or stopped dark colored vehicle struck from the rear at night may have had inoperative tail lights.
- The failure of a vehicle to stop or leave skidmarks after the operator perceived the hazard may indicate defective brakes or overloading.
- Vehicular condition may be suspected whenever a badly kept up or deteriorated vehicle is involved in an accident.

Specific Parts of a Vehicle as Contributors

Study Guide Exhibit 5-10 shows examples of the ways in which specific parts of the vehicle could contribute to an accident and suggestions for examination of these parts. The implications of various vehicle part failures are discussed below.

Exhibit 5-10

What the vehicle shows about why the accident happened*

Part of Vehicle	What it may show	Suggestions for
Tires	Blowouts, as contributing to out-of-control accidents, especially ran-off-road and head-on collisions. Generally one-car accident; rarely intersection or pedestrian accidents.	Look for evidence that tire rubbing or chewing all arou cords all around inside, ver inner tube, and extensive si Ragged holes in thin treads Examine road for flat tire n Unlikely in new tires.
Brakes	Brake failure, as contributing to accidents by slow stopping. Especially likely in intersection, rear-end and pedestrian accidents. Common on very heavily loaded trucks.	Skidmarks prove brake on t was adequate. Look for los draulic tubing not damaged pedal be pressed close to fl very heavily loaded for its added springs, wheels, or t loads? If vehicle not damag skid. If vehicle badly dama drums and brake bands for grease if any reason to beli
Steering gear, wheels and springs	Breakage contributes to the same kinds of accidents as tire blowouts. Suspension failure. May be some sign of overloaded brakes.	Look for broken parts, espe marks at edge of breaks, bo elongated on hub, wheel, sp pension hinges, and spring worn and loose ball and soc new vehicles. Check for pl wheels are undamaged. Is loose?
Wipers	Not working as contributing to accidents in rain or snow of almost any kind except backing. Especially likely at night and involving off-road, rear-end, and fixed-object collisions.	Inspect for presence of blad of switch or control knob. recent operation in wiped ar or clearer spots or fresh de stroke.

Exhibit 5-10

What the vehicle shows about why the accident happened*

ehicle	What it may show	Suggestions for examination
	Blowouts, as contributing to out-of-control accidents, especially ran-off-road and head-on collisions. Generally one-car accident; rarely intersection or pedestrian accidents.	Look for evidence that tire was run flat such as rim rubbing or chewing all around, tearing loose of cords all around inside, very badly torn or shredded inner tube, and extensive sidewall cracks as splits. Ragged holes in thin treads suggest blowouts. Examine road for flat tire marks back of key point. Unlikely in new tires.
	Brake failure, as contributing to accidents by slow stopping. Especially likely in intersection, rear-end and pedestrian accidents. Common on very heavily loaded trucks.	Skidmarks prove brake on the wheel leaving them was adequate. Look for loss of brake fluid if hydraulic tubing not damaged by collision. Can brake pedal be pressed close to floor boards? Was truck very heavily loaded for its size and did truck have added springs, wheels, or tires to carry greater loads? If vehicle not damaged too much try test skid. If vehicle badly damaged, examine brake drums and brake bands for wear, moisture, mud or grease if any reason to believe brakes inadequate.
r, wheels	Breakage contributes to the same kinds of accidents as tire blowouts. Suspension failure. May be some sign of overloaded brakes.	Look for broken parts, especially with slight rust marks at edge of breaks, bolt holes enlarged or elongated on hub, wheel, spindles, tie-rods, suspension hinges, and spring shackles. Look for worn and loose ball and socket connectors. Rare in new vehicles. Check for play in wheel where front wheels are undamaged. Is steering worn stiff, loose?
	Not working as contributing to accidents in rain or snow of almost any kind except backing. Especially likely at night and involving off-road, rear-end, and fixed-object collisions.	Inspect for presence of blades. Look for position of switch or control knob. Look for evidence of recent operation in wiped areas in form of streaks or clearer spots or fresh deposit at end of blade stroke.

Exhibit 5-10 (Continued)

What the vehicle shows about why the accident happened*

Part of Vehicle	What it may show	Suggestions for
Tail lights, slow signal light and turn indicator signals	Not lighted as contributing to rear-end collision mostly on unlighted roadways at night or in dense fog. In case of turn signal light, collisions with overtaking or left turning vehicles, day or night.	Look for switch position. T see whether undamaged ligh determine whether wiring w and if light works when shor times bulbs can be found in examined to determine whet Look especially for proper trailer and towing vehicles. poorly made trucks and esp
Headlights	One light out as contributing to head-on or sideswipe or pedestrian collisions at night on unlighted roads.	Look for switch position. T usually possible only in pede amine and test filament if it lamps to determine whether broken.
	Unlighted as contributing to pedestrian accidents or running into fixed or other objects, especially at dusk and in fog. Rarely head-on collisions or running off roads except in fog. Very dirty headlights as contributing to the same kind of accident when snow or mud is present.	Look for switch position. T damaged light works. If not wiring was shorted by dama light works when short is cl any vehicle due to driver ne Inspect for possibility of lan mud or snow.
	Dazzling as contributing to night accidents of car in ditch, rear-end and pedestrian collisions. Offending vehicle rarely involved. Applies for upper beams on level roads and lower beams on crests.	Offending vehicle rarely ava If available, usually undama position, although informati much. Test for aim of lam

Exhibit 5-10 (Continued)

What the vehicle shows about why the accident happened*

What it may show	Suggestions for examination
Not lighted as contributing to rear-end collision mostly on unlighted roadways at night or in dense fog. In case of turn signal light, collisions with overtaking or left turning vehicles, day or night.	Look for switch position. Try switch or brake to see whether undamaged light still works. If not, determine whether wiring was shorted by damage, and if light works when short is cleared. Sometimes bulbs can be found in damaged lamps and examined to determine whether filament was hot. Look especially for proper connection between trailer and towing vehicles. Common in old and poorly made trucks and especially such trailers.
One light out as contributing to head-on or sideswipe or pedestrian collisions at night on unlighted roads.	Look for switch position. Test if lamp is undamaged usually possible only in pedestrian accidents. Examine and test filament if it can be found in broken lamps to determine whether filament was hot or broken.
Unlighted as contributing to pedestrian accidents or running into fixed or other objects, especially at dusk and in fog. Rarely head-on collisions or running off roads except in fog. Very dirty headlights as contributing to the same kind of accident when snow or mud is present.	Look for switch position. Test to see whether undamaged light works. If not, determine whether wiring was shorted by damage and if undamaged light works when short is cleared. May occur in any vehicle due to driver neglect to turn on light. Inspect for possibility of lamp being covered by mud or snow.
Dazzling as contributing to night accidents of car in ditch, rear-end and pedestrian collisions. Offending vehicle rarely involved. Applies for upper beams on level roads and lower beams on crests.	Offending vehicle rarely available for examination. If available, usually undamaged. Test for beam position, although information may not be worth much. Test for aim of lamps.

Exhibit 5-10 (Continued)

What the vehicle shows about why the accident happened*

Part of Vehicle	What it may show	Suggestions for e
Trailer couplings or hitches	Break-away of trailers contributing especially to off-road and fixed-object collisions but also rarely to head-on and sideswipes. Especially likely when quick stops involved.	Examine for wear or broken gear failure. If guard chain spect to see whether they we so, whether broken. Especi in homemade and rental trail noticeable play in mount.
Windshield and windows	Visibility obscured by dirt, stickers, mud, frost, condensation. Blurred sections may be evident in cold, wet, or foggy weather.	Look for pre-accident crack glass.
Door locks	Broken as contributing to injury by failure of door in collision. Important only when passenger is thrown from car. Especially likely when collision results in considerable spin or vehicle makes furrows in roadside while moving sidewise and rolls over or vaults.	Look for broken latches or p jam. Examine side of car to been stretched by collision o side or middle of other side. dented for bend enough to un

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*Source: Exhibit 33-1, pages 186, 187, Traffic accident investigator's manual for police western University, Evanston, Illinois, used with special permission.

Exhibit 5-10 (Continued)

What the vehicle shows about why the accident happened*

	What it may show	Suggestions for examination
or	Break-away of trailers contributing especially to off-road and fixed-object collisions but also rarely to head-on and sideswipes. Especially likely when quick stops involved.	Examine for wear or broken parts as in steering gear failure. If guard chains are required, inspect to see whether they were provided, and, if so, whether broken. Especially likely to be found in homemade and rental trailer couplings. Look for noticeable play in mount.
	Visibility obscured by dirt, stickers, mud, frost, condensation. Blurred sections may be evident in cold, wet, or foggy weather.	Look for pre-accident cracks, broken, or missing glass.
	Broken as contributing to injury by failure of door in collision. Important only when passenger is thrown from car. Especially likely when collision results in considerable spin or vehicle makes furrows in roadside while moving sidewise and rolls over or vaults.	Look for broken latches or pawls on door and door jam. Examine side of car to see whether it has been stretched by collision on front or rear of that side or middle of other side. Examine door when dented for bend enough to unlatch.

-1, pages 186, 187, Traffic accident investigator's manual for police © 1963, North-
, Evanston, Illinois, used with special permission.

Tires. Tire failure at lawful speeds can usually be safely controlled for by experienced drivers. Tire failure coupled with a lack of driving skill can contribute to an accident.

Wheels. Wheel failure is not a frequent occurrence. If the front wheel bearings fail and a wheel is lost, then steering control would be lost. Gouges in the pavement left by a wheel support before the key point could indicate this.

Wheel suspension and springs. Ball joints, tie rods and springs occasionally fail. If they do, they will often leave conspicuous scratches or tire scuffs before the key point.

Brakes. These can fail or perform improperly. They can fail abruptly due to a rapid loss of brake fluid, or they can grab or lock unexpectedly causing an uncontrollable swerve or stop. Brakes can function ineffectively due to worn linings, low fluid reservoir, or poor adjustment. If conditions permit, a brake test should be made at the scene in cases where the brakes may be suspect.

Accelerator. Occasionally, the throttle linkage will seize or jam when the accelerator pedal is thrust to the floor (sometimes the accelerator pedal is mistaken for the brake pedal). This situation could result in a runaway vehicle.

Body features. A door latch may fail and permit a passenger to fall out. Some part or component of the vehicle may fall off and cause a distraction to the driver or present a roadway hazard to a following vehicle.

Headlights. One or the other can fail, presenting a deceptive picture of vehicle position to on-coming drivers at night. Improperly controlled or aligned headlights can cause a glare problem for opposing vehicles.

Tail lights and signal lights. These can fail or be obscured by road film or cargo, with the obvious consequences.

Windshield wipers. An ineffective or smearing windshield wiper could make a slight contribution.

Windows. Windows especially the windshield and rear window, could contribute, if obscured with snow, ice, dirt, or stickers. Tinted glass can be a factor, especially at night.

Passengers. Passengers can obscure the driver's vision, physically interfere with or distract the driver, tamper with vehicular controls or cause a fire.

Cargo. Various types of vehicular cargo can contribute by obscuring vision, interfering with the movement of the driver, distracting the driver, shifting and causing an unbalanced load, falling into the pathway of another vehicle, or spilling on the roadway or hazardously projecting into the roadway.

Questioning Passengers and Witnesses about Vehicular Condition

The patrolman should seek information about vehicle condition from passengers and witnesses. In many cases, more valuable and reliable information will be forthcoming from passengers and witnesses--drivers often tend to rationalize the situation by falsely claiming vehicle inadequacies. Some typical questions that may be asked of witnesses or passengers are:

- Did the driver complain of a vehicular defect or component failure?
- Was the driver warned or criticized about any aspect of vehicular condition?
- Did the driver appear to have difficulty controlling the vehicle?
- Did you hear or see anything that may have indicated a vehicular malfunction?

Correlate any account of vehicular part failure with the physical conditions. A pre-accident blow-out will cause characteristic marks to be left on the pavement as the tire loses pressure. A pre-accident failure of springs or tie rods can cause scratches or gouges to be left on the pavement before the key point is reached. Evidence of brake fluid spillage before the key point could indicate brake failure.

Basic Types of Unsatisfactory Vehicular Conditions

A sudden failure is some dramatic failure (such as tires, brakes, or steering) that is usually reported by the driver. Any such claim, of course, needs to be verified. If the vehicle in question is not badly damaged, then the suspect part of the system can be inspected and/or tested according to the guidelines suggested in Study Guide Exhibit 5-10. The major question always to be answered in the case of a damaged part is whether the damage was a pre-accident cause or a post-accident consequence.

A continuing defect is one which has existed for some time prior to the accident. This condition is likely a defect in one of the components or accessories of the vehicle (e.g., a shifting load causing a distraction, view obstruction, improper brakes or steering, inoperative brake lights, etc.) rather than some body or chassis condition. Continuing defects can be uncovered through the careful questioning of witnesses, passengers, and drivers, as well as an inspection and evaluation of the vehicle itself (if not too badly damaged) and the circumstances of the accident.

What the Vehicle May Show about the Nature of the Accident

General. Careful examination of the vehicle(s) involved in an accident can provide answers as to how the accident happened based on the nature of resultant damage, and why the accident occurred based on identification of any pre-accident deficient vehicular conditions. Detailed examination of vehicular damage may not be required to determine how an accident happened if satisfactory accounts are forthcoming from the principals and witnesses. However, when conflicting or incomplete statements are forthcoming, close inspection of vehicular damage may be the only reliable source of information. It will be necessary for the patrolman to keep in mind and differentiate among the various kinds of damage or disrepair he may discover, namely:

- Pre-collision/not contributing (e.g., non-functioning headlight during the day)
- Pre-collision/contributing (e.g., broken wheel suspension, badly leaking master cylinder)
- During collision (e.g., dents, broken glass, collapsed parts)
- Post-collision/before final position (may show how second collision occurred)

- Post-collision/after final position (e.g., damage incurred due to rescue operations, recovery of vehicle, vandalism, etc.)
- Post-collision, during removal (e.g., damage incurred as a result of towing or otherwise moving vehicles from the scene)

Examining the vehicle. Study Guide Exhibit 5-11 reviews the activities performed in examining vehicle condition to determine how the accident happened. With the vehicle in a safe position, the patrolman should check on the following initially:

- If at night, are all lights operative?
- Had the vehicle been moved since its final resting point?
- Are there any parts of vehicle in contact with the ground other than the tires?
- Are any tires flat? If so, what is the condition of the tires?
- What is the position of the gearshift lever?

The patrolman should correlate the significant points of driver, passenger, and witness accounts of how the accident happened with vehicular damage (e.g., such points as the angle of collision, extent of damage, relative positions of vehicles on the road).

Types of vehicular damage. The basic types of vehicular damage are described below.

- Contact damage. This is damage that is the result of a collision between two bodies. It includes such damage as crumpled, distorted, and broken parts of the vehicle (e.g., crumpled fender, broken headlamp).
- Induced damage. This is damage that is not the result of direct contact between two colliding bodies, but due to the transmission of contact force through the vehicle (e.g., shock or progressive distortion). This could include such damage as a crumpled dashboard due to the

Exhibit 5-11

What the vehicle shows about how the accident happened*

Part of Vehicle	What it may show	Suggestions for
Body, especially bumpers, fenders, side panels, doors, grill work, trunk lid, but also including glass	By damage, the direction of the force, the degree of overlap of colliding vehicles, and the extent of maximum engagement. By prints and rub-off what parts of the vehicle were in contact with what parts of other vehicles or what fixed objects or even pedestrians. Whether the vehicle turned over.	Study the distortion and coll which way they were bent o from photographs. Examin objects. Do not be confuse Look for rubber rubbed fro and prints of bumpers, bum door handles, and poles or accidents, examine surface buttons, scratches, hair or from photographs. Windsh show injured person's conta by glass fractures. Doors collision, especially in righ between ripping or glancing depressing ones.
Interior, especially doors, hinges, steering wheel, dash board, and front seat	By damage due to occupants, body, or freight, the direction from which the collision forces came and something of their severity.	Examine shatter patterns o seat backs, outward bulges and breakdown of steering v
Tires	By cuts, direction from which force came and its general strength. By side and tread abrasions, direction of sidewise movement. By tread and shoulder patterns, which wheel left tire print on other vehicle or road.	A tire cut or blown by accid greater than those from me damage. Position of cuts m cause of wheel rotation afte damaged in collision usually sidewall tears only at one p corresponding dents or scr heavy abrasions on sidewall pavement and grass or twig tire and the rim showing wh furrows on the roadside. C match with skidmarks or pr

Exhibit 5-11

What the vehicle shows about how the accident happened*

f Vehicle	What it may show	Suggestions for examination
pecially fenders, ls, doors, x, trunk lid, ncluding	By damage, the direction of the force, the degree of overlap of colliding vehicles, and the extent of maximum engagement. By prints and rub-off what parts of the vehicle were in contact with what parts of other vehicles or what fixed objects or even pedestrians. Whether the vehicle turned over.	Study the distortion and collapse of parts to find out which way they were bent or pushed. May be done from photographs. Examine for paint from other objects. Do not be confused by undercoat laid bare. Look for rubber rubbed from tires of other vehicles and prints of bumpers, bumper guards, headlights, door handles, and poles or trees. In pedestrian accidents, examine surfaces for cloth imprints, buttons, scratches, hair or skin. Not easy to do from photographs. Windshields and windows can show injured person's contact and direction of force by glass fractures. Doors indicate severity of collision, especially in right angle. Distinguish between ripping or glancing marks and crushing or depressing ones.
especially nges, steer- , dash d front	By damage due to occupants, body, or freight, the direction from which the collision forces came and something of their severity.	Examine shatter patterns of glass, breakdown of seat backs, outward bulges of doors, dents in dash and breakdown of steering wheel.
	By cuts, direction from which force came and its general strength. By side and tread abrasions, direction of sidewise movement. By tread and shoulder patterns, which wheel left tire print on other vehicle or road.	A tire cut or blown by accident means forces much greater than those from mere body and bumper damage. Position of cuts may be misleading because of wheel rotation after collision. Tires damaged in collision usually show sharp cuts or sidewall tears only at one point and usually near corresponding dents or scratches in rim. Look for heavy abrasions on sidewall showing side scuff on pavement and grass or twigs pinched between the tire and the rim showing which wheel left turf furrows on the roadside. Count tread grooves to match with skidmarks or print patterns. Measure

Exhibit 5-11 (Continued)

What the vehicle shows about how the accident happened*

Part of Vehicle	What it may show	Suggestions for
Tires (continued)		shoulder rib spacing to ma on pavement and on bumpe vehicle.
Gear position, especially on trucks	May give clue as to possible speed.	Look to see what gear vehi set upper limit to speed bu show lower limit. Mechan to examine to see what gea
Couplings or hitches for trailers and fifth wheels for semi-trailers.	By breakage may show direction and extent of forces.	Look for sheared bolts and evidence of wear to indicat between the trailer and tow
Speedometer	May show speed before collision if jammed but highly unreliable.	Was dial rotated in its mou broken from front by force rear by collision? Note r
Springs, A-frames, other parts of wheel suspension, steering gear, and rear axle.	By breakage or bending, the direction and extent of force. By abrasion can show part that dragged on road.	Look for direction of bendi direction of force. Any be these strong parts means g ground or scratched under inside ends, to indicate wh contact with road.
Frame and axles	By bending, direction and extent of force. By abrasions, parts in contact with roadway.	Frame easily springs, but needed to bend it much. E evaluating direction and an blows on the side of the ve
Engine and transmission	By damage, the direction or the extent of force. By abrasions, parts in contact with the roadway.	Is engine off its mounts or mission casing broken ope quired for such damage. of these parts helps show

Exhibit 5-11 (Continued)

What the vehicle shows about how the accident happened*

f Vehicle	What it may show	Suggestions for examination
ontinued)		shoulder rib spacing to match with scuff marks on pavement and on bumpers of body of other vehicle.
ition, y on trucks	May give clue as to possible speed.	Look to see what gear vehicle is in. Lower gears set upper limit to speed but high gears do not show lower limit. Mechanic or driver may have to examine to see what gear position is in.
s or hitches ers and fifth or semi-	By breakage may show direction and extent of forces.	Look for sheared bolts and bent parts without evidence of wear to indicate direction of force between the trailer and towing vehicle.
eter	May show speed before collision if jammed but highly unreliable.	Was dial rotated in its mounting? Was device broken from front by force of passengers from rear by collision? Note reading.
A-frames, ts of wheel on, steering d rear	By breakage or bending, the direction and extent of force. By abrasion can show part that dragged on road.	Look for direction of bending or breakage to show direction of force. Any bending or breaking of these strong parts means great force. Look for ground or scratched under-parts, especially the inside ends, to indicate which part came in contact with road.
nd axles	By bending, direction and extent of force. By abrasions, parts in contact with roadway.	Frame easily springs, but heavy forces are needed to bend it much. Especially useful in evaluating direction and amount of forces and blows on the side of the vehicle.
nd trans-	By damage, the direction or the extent of force. By abrasions, parts in contact with the roadway.	Is engine off its mounts or oil pan or transmission casing broken open? Great force is required for such damage. Direction of movement of these parts helps show direction of force.

Exhibit 5-11 (Continued)

What the vehicle shows about how the accident happened*

Part of Vehicle	What it may show	Suggestions for exa
Engine and transmission (continued)		Little force required to damag they are good to show directio mission broken down, look for the ground.
Wheels	By rim dents and dishing may show degree and direction of force By rub-off and scratches, position and nature of contact with other vehicles. By displacement, distortion of wheel suspension and frame. By braking, overload or high speed.	Rim denting of wheels shows g wheels are strong. Remembe rotated after collision. Wheel from hub show heavy side thru on rim edge indicate pavement show its direction. Scratches contact, especially with bumpe rails. Measure wheelbase of c show collapse of wheels, wheel frame. Also measure off-set side thrust.
Light bulbs	By oxidation of filament and oxide deposits, whether light was on when bulb was broken. By distortion of filament something about forces accelerating the vehicle.	Remove remains of bulb very c cracks to prevent breakage dur Handle carefully. Microscopic necessary. Bulb does not have significant damage. Be sure t came from.

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*Source: Exhibit 37-2, pages 286, 287, Traffic accident investigator's manual for police © Northwestern University, Evanston, Illinois, used with special permission.

Exhibit 5-11 (Continued)

What the vehicle shows about how the accident happened*

What it may show	Suggestions for examination
	Little force required to damage radiator, fan, but they are good to show direction. If engine or transmission broken down, look for signs of scraping on the ground.
By rim dents and dishing may show degree and direction of force By rub-off and scratches, position and nature of contact with other vehicles. By displacement, distortion of wheel suspension and frame. By braking, overload or high speed.	Rim denting of wheels shows great force because wheels are strong. Remember wheel may have rotated after collision. Wheels dished or broken from hub show heavy side thrust. Rough abrasions on rim edge indicate pavement drag and sometimes show its direction. Scratches and rub-off show contact, especially with bumpers, curbs, and guard rails. Measure wheelbase of car as damaged to show collapse of wheels, wheel suspension and frame. Also measure off-set of wheels to show side thrust.
By oxidation of filament and oxide deposits, whether light was on when bulb was broken. By distortion of filament something about forces accelerating the vehicle.	Remove remains of bulb very carefully. Tape cracks to prevent breakage during removal. Handle carefully. Microscopic examination may be necessary. Bulb does not have to be broken to have significant damage. Be sure to identify where bulb came from.

, pages 286, 287, Traffic accident investigator's manual for police © 1963
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engine being pushed into the passenger compartment or a broken windshield due to a distortion of the windshield frame.

It is important for the patrolman to distinguish between contact and induced damage. The extent of contact damage can help determine the exact relative position of the vehicles at the point of collision and whether more than one collision took place, which is often the case. Multiple contact damage areas are separated by undamaged areas or areas of induced damage.

What a study of vehicular damage can show. Close examination of vehicle associated damage can uncover many indications of how the accident happened.

- Collapse. This is the crumpling or collapse of vehicular parts due to the forces of collision. The nature and extent of collapse can indicate direction of travel and position at collision, as well as the magnitude of collision force.

- Overlap. This refers to the overlap of vehicular parts with another vehicle or fixed object. Again, this can be an indication of the forces in effect at collision.

- Thrust. This is indicated by the nature of contact damage. Basically, it is shown by the angle of the edge of collapse of metal in relation to the longitudinal axis of the vehicle--the direction of push.

- Accident versus pre-accident damage. Damage to such metal parts as wheels, suspension, steering linkage, engine body frame, etc., must likely be accident-induced damage, otherwise the vehicle could not have been driven properly. Damage to other more fragile and less instrumental parts to basic vehicle control is often difficult to classify as to time of occurrence.

- Speed estimate. Only an approximation of speed at the time of collision can be made from an inspection of vehicular damage, and this is a job for a technical expert. The estimate is more accurately determined if a vehicle collides with solid fixed object (almost all of the energy goes into the vehicle). The strength of vehicular parts is an important factor in estimating collision speed. A weakly constructed vehicle engaged in a low speed crash can incur a great deal of damage, suggestive of a high speed impact and vice versa. It is difficult to estimate collision speeds from cars which have collided with each other. The complication is that either vehicle could have been standing still or both could have been moving.

- Imprints. These would include dents pressed into the softer parts of a vehicle with a characteristic shape of the stronger object doing the imprinting (e.g., telephone poles, truck bumpers). A study of imprints helps to determine the point of mutual contact. It may be necessary to measure the location of imprints to obtain a positive match with the imprinting object. The height of an imprint from ground level is often useful. The patrolman should keep in mind that parts of the front of a vehicle involved in a collision may be lower than usual, due to the front end lowering during hard braking.

- Rub-off. This refers to a condition where the surface material of one object rubs off on the surface of the other object as a result of the collision forces. Materials that typically rub-off and cling to vehicles are:

  - Paint
  - Tire rubber
  - Human/animal skin, hair, blood
  - Clothing fibers
  - Tree bark
  - Mud, grass, etc.

  These materials often constitute useful clues for apprehending hit and run drivers.

- Road contact damage. When grooves, scratches, or gouges are left in the roadway, the patrolman should look for corresponding abrasions, distortions of vehicular parts that could have caused the marks. The soft parts of the trafficway (tar, asphalt, grass) may still cling to the marking vehicular parts. The patrolman should document all unusual vehicular parts which appear to have contacted the ground.

- Tires. Tires are commonly cut, or scuffed and melted away by skidding on the road surface. The scuffing or melting of a tire, if not too extensive, is sometimes difficult to see when a tire rolls after skidding. Tires should be closely inspected for such damage.

- Headlights. Broken pieces of headlights found at the scene can be matched to broken headlights on vehicles (an important clue in hit and run cases). One can tell if a headlight was on when the lens was broken. If the lights were on when the lens was broken, then the hot filaments will have oxidized and darkened. If the lights were not on when the lens was broken, then the filaments should appear clean and untarnished. In some cases, it may be necessary to carefully remove and tag lights for laboratory analysis. The patrolman should not manipulate any dashboard controls; if the headlights were broken and the light switch were inadvertently turned on, the exposed filaments would burn up, destroying evidence.

What the Vehicle Can Show about the Extent of Personal Injury

The nature and extent of personal injury often can be inferred from damage to the vehicle.

Interior compartment. Interior damage and personal injury can be the result of moving cargo or passengers. There are many interior sources of personal injury. Damage to such components listed below, could indicate sources of personal injury:

- Windows
- Steering wheel
- Dashboard
- Roof accessories (if vehicle rolled over)
- Seat backs (collapsed due to catapulted passengers, or cargo)

Vehicle exterior. A collision with a pedestrian can be confirmed as a result of exterior damage or marking resulting from the following occurrences:

- A head-on collision as indicated by a headlight or grill fracture, or dents in fenders and hood
- A sideswipe, as indicated by brush marks from buttons and clothes
- A rear end collision while backing as shown by blood and torn clothing attached to the bumper, trunk, lights, or license plate
- A run over as shown by blood and/or clothing fragments caught on underbody

Noting Critical Features of Vehicular Condition

The patrolman should note and record the condition/operability of such major components or subsystems as:

- Wheels
- Tires
- Brakes
- Steering
- Seat belts

In addition, he should observe and note the:

- Gear shift position which may indicate possible maximum speed before collision
- Speedometer reading which is generally zero, but it may be locked at a speed reading near that at the time of crash (reading could be higher than actual speed)
- Door condition, in particular:
    - Were any doors forced open by the collision or rollover?
    - Were door locks engaged?

  - Were any doors jammed shut?

  - Are doors presently operable?

- Interior damage (e.g., steering wheel, dashboard, etc.)

- Type of windshield damage

Information about vehicular condition and damage should be recorded on the accident report form and in the officer's field notes.

Pedestrian Accidents

In the case of a pedestrian accident, the patrolman should inspect the vehicle for signs of contact with the pedestrian. The location of any clothing fibers, blood stains, skin or hair on a vehicle should be carefully noted. Samples of these substances should be carefully collected, labeled and preserved. Laboratory tests should be conducted on samples collected from the vehicle and the pedestrian to determine any match-ups.

Preservation of Physical Evidence

The patrolman should be alert to find and properly identify parts and pieces of the vehicle which may serve as evidence. The kinds of materials that may serve as evidence are headlights; headlight fragments; tires; pieces of body showing rub-off or contact with road; scrapings of paint, hair, skin, and fibers.

ACCIDENT MANAGEMENT PROCEDURES, PART V
OBTAINING INFORMATION FROM THE TRAFFICWAY

How the Trafficway Can Contribute to an Accident

The trafficway and weather conditions often combine with driver and vehicular conditions to cause accidents. During the course of accident investigation, the patrolman must be alert to find defects on the trafficway environment, so that highway engineers can correct any design deficiencies. Trafficway defects are frequently claimed as accident causes by drivers and therefore must be verified by the patrolman. The patrolman should bear in mind that just because a hazardous road or weather condition is in effect at the scene of an accident, it does not mean that either was the cause of an accident. For instance, consider the situation where a greatly fatigued driver runs off the road on a foggy, rainy night. The first temptation might be to cite the environmental conditions as causes witho considering the driver condition that would have caused the accident regardless of the environmental conditions.

Common Trafficway Deficiencies

The trafficway conditions that can contribute to the occurrence of traffic accidents, are reviewed below.

View obstructions. In-the-road obstructions are created by the position of parked cars which often interferes with the driver's view of pedestrian traffic. Large vehicles (buses, trucks) at intersections can block the driver's view of oncoming traffic as well as traffic control devices.

Off the road view obstructions such as embankments, buildings, billboards and vegetation (trees, shrubs) can restrict a driver's view of oncoming traffic at intersections. If such apparent obstructions are present, their location must be measured and indicated on the accident field sketch or diagram.

Roadway contours such as small hills or dips in the roadway can block the driver's view of oncoming traffic. This factor is often instrumental in accidents involving one vehicle overtaking another, where no-passing lines are obliterated or improperly placed.

Reduced visibility. Darkness, as such, can only be considered a factor if the accident could not have occurred in daylight. Drivers often "overdrive" their headlight beams and this could be suspected when an unlighted object (pedestrian, fixed object) is struck at night.

Fog/smoke often appears and disappears quickly. Interrogation of people at the scene may be necessary to uncover this factor. Pockets of smoke and fog are often the cause of chain reaction, rear end collisions.

Dense precipitation (rain, snow, hail), while falling, can reduce visibility while also causing a slippery condition on the roadway surface.

Glare is an interference with normal vision which is hard to evaluate, because it is a temporary and quickly passing condition. Vehicles with improperly adjusted headlights, which may have contributed to the accident often are not directly involved in any collision and have left the scene. "Glare" is reported sometimes by a driver to rationalize his faulty condition or action (e. g., fatigue, excessive speed). There are three basic types of glare situations:

- Headlights--it is a driver's fault if he fails to lower his high beams on approach of an opposing vehicle or upon approach of another vehicle from the rear or his headlights are not properly adjusted.

- Back lighting--in some situations a bright source of light (spot light, brightly lit advertisement) can mask the perception of a traffic control device.

- Sun glare--this occurs within 1-1 2 hours after sunrise or before sunset; the sun must either be directly ahead of the vehicle to be a factor, or reflected off a shiny surface.

Surface conditions. Slipperiness is a common causal factor in traffic accidents. It can cause an unexpected hazardous condition, prevent successful evasive action and increase the severity of an unavoidable accident. Slippery road surface conditions are most often caused by moisture, ice and snow, loose gravel, sand, wet leaves or grass, oil/grease spots, and asphalt or tar softened by hot weather. Skidmarks are often not found during slippery conditions, even though hard braking and skidding occurred.

Ruts can cause a steering problem when it is difficult to turn the wheel. This is generally a factor at higher driving speeds, especially if the ruts run lengthwise to the roadway. A rut more than 3" deep may, in some cases, cause overturning.

Holes have to be 1' or more in length to cause a loss of steering control.

Curbs/low shoulders can act like ruts in that they can channel the front wheels engaging a low shoulder and could cause sharp steering to be put in before the vehicle responds with a radical turn in the direction of the steering action. If a vehicle on the left side of the roadway is hit head-on or sideswiped, or if the vehicle in question is in a ditch on either side of the road or has skidded on the roadway without an encounter with another vehicle, then the existence of a low shoulder or rut several hundred feet before the key event can be suspected.

Scuffmarks on the tires or wheel rims can support the influence of ruts, holes, curbs or low shoulder.

Engaging a soft shoulder can throw a vehicle out of control, turn it over, or stop it quickly enough to cause injury to the occupants of a vehicle.

Many forms of debris on the road can cause accident producing situations (e.g., detached vehicular parts such as those associated with the exhaust system, fallen or spilled cargo, etc.).

Road alignment. For every roadway curve, there is a "critical speed" at which the cumulative effect of side forces is too great and the vehicle slips off the curve. Thus, speed coupled with the degree of roadway curvature and slipperiness can cause the vehicle to leave the road. The critical speed of any given curve can be calculated if one knows the radius of the curve, the degree of bank or grading of the curve, and the slipperiness of the road surface.

The sudden narrowing of the pavement, such as found in some cases at bridges, or caused by culvert walls, underpass abutments, guard rails, etc., can contribute to some accidents.

Traffic control devices. For every traffic accident, the patrolman should always make it a point to determine if the traffic control devices in the vicinity were in the proper condition or working order. Often overlooked as a cause, unsatisfactorily functioning traffic control devices can contribute in the following ways:

- A sign can be obscured by adhering snow, road film, overgrowth of plants or tree foliage, parked vehicles, etc.
- A sign or pavement marking could be missing due to vandalism or progressive deterioration.
- A traffic signal could be malfunctioning or inoperative.

Any trafficway deficiencies uncovered in an accident investigation must be reported through channels to the highway/traffic engineering department so that corrective action may be initiated.

What the Trafficway Can Show about the Nature of the Accident

Basic classes of physical evidence. Often, the only irrefutable means for determining how and why the accident occurred is by examination of the physical evidence on the roadway at the scene. There are seven basic classes of evidence that may be found on the roadway, namely:

- Debris
- Marks on roadway by hard objects
- Tire imprints
- Tire skidmarks
- Tire scuffmarks
- Damage to roadside objects
- Miscellaneous road marks

Debris. Measurement and depiction of the location of the various forms of debris to be discussed below are important tasks for the patrolman. Evaluation of the type and location of roadway debris, such as vehicle underbody debris, vehicle parts, vehicle fluids, cargo, clothing, blood, and personal possessions, can have an important bearing on the investigation. The basic classes of roadway debris of interest to the investigator are:

- Underbody debris. This is the accumulated road tar, mud, rust, etc., that can be jarred loose from the vehicle's underbody during the collision. If a well-defined heap of underbody debris is found in a spot on the road, it may indicate that the vehicle (s) did not move very much after initial contact. Widely scattered underbody debris is more commonly found, and indicates that the vehicle (s) moved considerably after initial contact.

Sometimes loosened underbody debris falls into the tire tread, and an amount of debris can be deposited in the roadway with each rotation of the tire. This indicates that the vehicle was nearly at rest when struck, otherwise the debris would not have been concentrated on one spot on the tire. The beginning of the deposit can show the point of initial contact as well as the direction of vehicular movement after impact.

- Vehicular parts. These objects are not as useful as some others in determining accident events, positions, and pathways, as they can become widely scattered. The presence of scattered vehicular parts can indicate severe collision force. Vehicular parts can be implanted in or left adhered to roadside objects, indicating the pathway of a vehicle.

- Vehicular fluids. Spilled fluids that may be observed are radiator coolant, crankcase oil, fuel, transmission fluid, brake fluid, and battery fluid. The beginning of a trail of fluid leakage can indicate the point of impact. Fluid leakage can be deposited as a tire print.

- Cargo. The location and description of the amount of any volatile liquid cargo (gasoline, solvents, etc.) should be noted rapidly, as the material will evaporate. Granular cargo (e.g., gravel, grain, chemical fertilizer, coal, etc.) can drop in a localized manner like underbody debris, but because of its elevation, it is likely to travel farther and scatter more rapidly. Heavy cargo (livestock, freight) tends to travel longer with the vehicle, and its final position is not as informative as that of other debris.

- Blood. Blood accumulation on the road may show where a body was struck, in which direction a body travelled, or where a body came to rest.

Marks on the roadway by hard objects. Marks left on the pavement by hard objects (e.g., underbody parts, wheel rims, body parts, etc.) are distinguishable from tire marks. Such marks as scratches, scrapes, and gouges involve damage and/or physical change to the pavement. Striations or grooves can be left on the roadway as well as the rub-off of paint and soft metal. Study of these road marks can help to locate the pathway of a vehicle after collision, as these marks are generally left by parts of a vehicle that have been damaged by the collision. These roadmarks should be matched up with the parts of the vehicle causing the marks. Furrows can also be left in soft roadside materials by the hard metal parts of a vehicle.

Tire imprints. These are marks left on the pavement or ground by rolling, not skidding tires. Several types of imprints that can be found are:

- Prints left on the pavement surface by a deposit of wet or sticky material.
- Impressions of a tire tread in soft material.
- Loose or soft deposits left on the road by material caught in the tread of a tire (underbody debris, or material picked up from the roadway).

Imprints show the position and direction of a vehicle on the roadway. Imprints are distinguishable from skidmarks, because rolling wheels show tread marks, and points or ridges of sticky material pulled away from the tire. Imprints can obscure skid and scuff marks, since they are often left by vehicles not involved in the accident. Most imprints are not durable and disappear rapidly; they, therefore, should be identified, measured, and located in a field sketch as soon as possible.

Tire skidmarks. These are the marks left by a locked wheel that is sliding or skidding on the roadway. A skidding tire can leave at least two of the nine basic types of skidmarks on a road surface, e.g.:

- Pavement grinding. This refers to the scratches caused by particles of abrasive material embedded in a tire (or studs) too cold to smear on the pavement. This type of skidmark can persist for some time.
- Tire grinding. This is a mark caused by a collection of tire particles being left on the pavement by a sliding tire before it becomes heated enough to melt and smear. These particles are subject to being blown or washed away.

- Erasing. This effects is caused by a skidding tire which cleans the dirt or road film from the pavement. It is called a "shadow" and is difficult to see or photograph and does not last very long.

- Squeegee marks. These are indicated by an area of pavement where the moisture has been rubbed off by a sliding tire. This type of mark is easy to see, but disappears rapidly.

- Soft material smear. This type of mark is left by snow, mud, or wet debris that is smoothed or spread over the road surface by a sliding tire. No tread mark is visible, except, in some cases, at the end of a skid where the tire starts to roll again.

- Bituminous material smear. This is asphalt or tar material that is spread on the road by a sliding tire that gets hot enough to melt the road material, but not itself. This is a dark, black mark that is easy to see and lasts for some period of time.

- Tire smear. This is the deposit of tire rubber on the road surface made by a sliding tire that has been heated by friction sufficiently to melt. Tire smears usually persist for some time.

- Tire scrub. This is a spot or tire smear that is caused by the downward forces exerted on a tire by a violent collision. A tire scrub can mark the point of maximum engagement.

- Furrow. This refers to a trench produced by a sliding tire in soft material (earth, gravel, etc.). The soft material in which the furrow is made usually accumulates at each side and at the end of the furrow.

The presence of skidmarks indicates the position and track of the wheels leaving them, that the wheels were locked by hard braking by the driver, and the minimum speed of the vehicle. The absence of skidmarks at the scene of a collision could indicate faulty evasive action, delayed perception, inadequate braking by the driver, or a faulty brake system.

There are four basic classes of skidmarks:

- Straight skids. Study Guide Exhibit 5-12 shows examples of straight skids where both rear-wheel skidmarks do not go off to one side of the front wheel skidmarks. Straight skids generally result when all four wheels lock up uniformly.

- Curved skids. Study Guide Exhibit 5-13 shows examples of curved skids which result when a car turns, spins or rotates as it slides. Both rear wheel skidmarks go off to one side of the front wheel skidmarks. Curved skids result when:

    - The front wheels lock up after the rear wheels

    - Wheels on one side of the vehicle lock up on a slippery surface

    - Car is turned during hard braking

- Overlapping skids. Study Guide Exhibit 5-14 shows an example of a completely overlapping skid where the rear wheel overtracks the front wheel skid. This is caused by very uniform braking on all four wheels. It is difficult to find where the front wheel skid has begun. The beginning of an overlapping skid is made by the rear tires and the end of the skid is marked by the front tires.

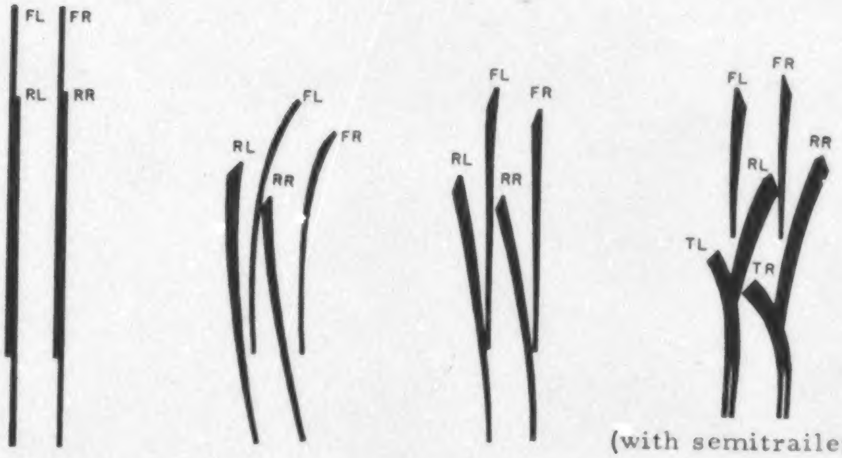
- Offset skids. This type of skidmark often results at the point of collision and can therefore mark the key point.

Gaps in skidmarks are the interruptions in skidmarks caused by the release and reapplication of the brakes (could also be brake drums out of round). Gaps generally are 10 feet or longer and should not be included in the measurement of skidmark length.

Skips in skidmarks are interruptions in a skidmark without the brakes being released and can be caused by a locked wheel hitting a bump, rut or hole in the road, or the wheels of a lightly loaded tractor-trailer being suddenly locked up. Skips are generally 2 or 3 feet in length, and should be included in the measurement of skidmark length.

Exhibit 5-12

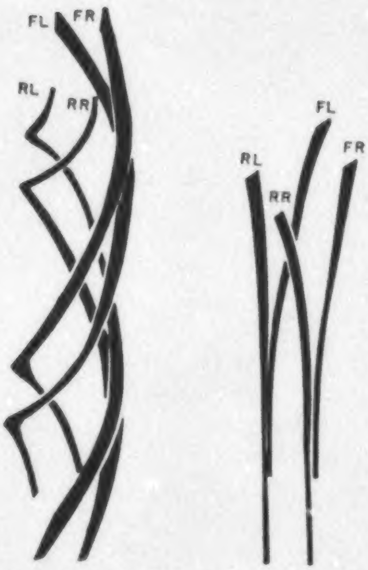
Examples of straight skidmarks*


FL
FR
RL
RR
FL
RL
FR
RR
FL
FR
RL
RR
FL
FR
RR
RL
TL
TR

(with semitrailer)

Exhibit 5-13

Examples of curved skidmarks**


FL
FR
RL
RR
FL
FR
RL
RR

(one complete spin)

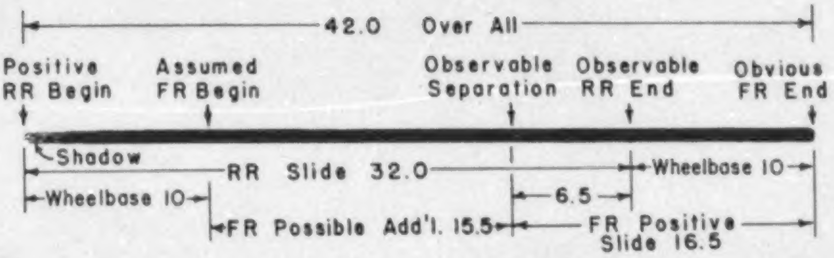
---

*Source: Exhibit 52-6, page 513, Traffic accident investigator's ma for police

**Source: Exhibit 52-7, page 515, Traffic accident investigator's ma for police © 1963, Northwestern University, Evanston, Illinois, us with special permission.

Exhibit 5-14

Example of a completely overlapping skidmark
and associated measurements*


42.0 Over All
Positive RR Begin
Assumed FR Begin
Observable Separation
Observable RR End
Obvious FR End
Shadow
RR Slide 32.0
Wheelbase 10
Wheelbase 10
6.5
FR Possible Add'l. 15.5
FR Positive Slide 16.5

---

*Source: Exhibit 42-4, page 381, Traffic accident investigator's manual for police © 1963 Northwestern University, Evanston, Illinois, used with special permission.

Skidmarks can disappear as a result of obliteration or wearing away by passing traffic, the destructive action of the feet of pedestrians, bystanders, and official personnel, the washing away by rain or snow, the destruction of wet or fragile particles by the sun and wind, and the attempts of certain individuals to destroy evidence. Skidmarks should be protected as if they were "fingerprint" evidence. The patrolman should consider using barricades or responsible persons to guard them until he can analyze and record the skidmark evidence.

In processing skidmark evidence, the patrolman should be concerned with positively associating the skidmark(s) with each marking vehicle. The vehicle tires may actually mark the end of the skid. It may be necessary to count the number of tread ribs evident in any skidmark to match up with the tires of vehicles at the scene.

It is important to note where skidmarks begin and end. To determine the beginning of a skidmark, the patrolman should look in the direction of the skid with his eye level about one foot from the ground level. In establishing where skidmarks end, the most conclusive confirmation is where a stopped vehicle marks the end of a skidmark. An abrupt termination of a dark smear is generally indicative of the end of a skidmark. A pile of debris at the end of skidmarks may also be indicative of the end.

It is usually necessary to differentiate between front wheel and rear wheel skidmarks. Front wheel marks are usually somewhat broader and more distinct because of the relatively greater weight placed upon the front wheels during braking.

Tire scuff marks. These are marks left on the road by tires that are sliding or "scrubbing" while the wheel is still rolling. There are five major types of scuff marks.

- Decelerating scuffs. These usually occur before skidmarks start to show and indicate that braking was involved.
- Accelerating scuffs. These are caused by the application of abrupt engine power causing the rear wheels to spin. Often these marks have road material deposited on top by the action of the spinning rear wheels.

- Side scuffs. These are made by a vehicle steering around a corner without braking or power being applied, but with the tires sliding sideways. These marks are characterized by diagonal striations on the pavement, whose direction should be noted on the accident diagram.

- Combination scuffs. This is generally a combination of side scuff with an accelerating or decelerating scuff.

- Flat tire scuffs. These are left by the edges of flat or underinflated tires. The marks consist of rubber or bituminous material. The presence of this type of mark can indicate that a blowout or puncture may have been a factor.

Scuff marks do not last as long as many skidmarks. This is due to the fact that there is little smearing involved (melting of tire or road surface, which is the most durable form of roadmark), since the rolling tire is continually bringing a new cool part of the tire in contact with the road surface.

Damage to roadside objects. Broken or damaged roadside objects such as walls, fences, signs, poles, vegetation, etc., can show the pathway of a vehicle after leaving the road. Damage incurred by roadside objects should be matched up to vehicular damage, whenever possible. For instance, the paint deposited on a stone wall should be matched to paint of a damaged vehicle at the scene. Roadside object damage should be noted and recorded promptly for items that are likely to be repaired quickly (e.g., utility poles, farm fencing, etc.).

Miscellaneous roadmarks. There are other types of roadmarks that may be present that do not fit into the previous categories, such as pedestrian slide marks which may consist of particles of clothing, a cleared pathway on the road or a blood smear left by a dragged body. In addition, holes could be left by bumpers, doors, roof corners, etc.

ACCIDENT MANAGEMENT PROCEDURES, PART VI

MEASUREMENTS AND DIAGRAMS IN ACCIDENT INVESTIGATION

Purposes of Measurement

Measurements at the accident scene make it possible to accurately locate significant objects and events at the accident scene. Measurements take a great deal of the approximation out of accident reconstruction. They form a sound basis to draw scientific conclusions about various aspects of the accident as well as to permit accurate testimony for resultant court cases.

Measurements are generally required to be taken in connection with:

- All fatal accidents
- Most serious injury accidents
- Accidents where a vehicle ran off a curve
- Accidents involving a suspected view obstruction
- Apparently unexplained, unusual or freak accidents
- Accidents involving prosecution for such offenses as driving on the wrong side, cutting corners and other improper positions and directions
- Accidents on or near jurisdictional boundaries, government owned or private property boundaries

Measurements are usually made of such things as skidmark lengths and widths, sight distances, road width, distortion of vehicular wheelbase (hub to hub measurement on each side) and the location of:

- The vehicle on the road before the collision (tiremarks, gouges)
- Point of impact or point where vehicle left the road as indicated by debris and roadmarks
- Final resting point of vehicle after the collision
- Camera position, wherever it was used

The patrolman must realize that the location of some substances must be measured quickly, as these substances or objects may disappear or be lost in a short period of time. The basic types of measurements which the patrolman must plan to accommodate are:

- Temporary items (may last only a few minutes)
    - Tire prints
    - Gasoline and water puddles
    - Vehicle debris
    - Injured or dead parties
    - Vehicle position in a traveled roadway
- Short-lived items (may last several hours or days)
    - Skidmark smears
    - Gouges or furrows
    - Oil and blood stains
    - Damaged fixed objects
    - Vehicle position off the roadway
- Permanent items
    - Trafficway dimensions
    - Sight distances
    - Gradient
    - Location of traffic control devices
    - Distance between landmarks used for triangulation, etc.

General Measurement Procedures

The following are the basic steps to be followed in taking field measurements:

Decide which items need urgent measurement. The patrolman should attend to measuring temporary and short-lived evidence as soon as time permits. In addition, he should post people or barriers to guard the item to be measured, and mark the outline of items such as injured or dead persons, puddles or piles of debris, and wheel locations. If necessary, he should mark the points between which the distance will be measured (e. g., beginning and end of an imprint or skidmark), and attend to measuring fixed objects or landmarks after urgent measurements have been completed.

Determine how the measurements will be recorded. Measurements are conveniently recorded on a rough field sketch which should be made prior to taking measurements.

Take the measurement. When taking measurements, the patrolman must account for his own safety. If necessary, the patrolman should post someone to control traffic to allow a safe measurement to be made. If using a steel tape, the patrolman should never let the tape touch a wire or area that may be electrified.

If working with an assistant, the following basic procedures may be followed in measuring distances:

- One individual will anchor the tape at one end of the distance to be measured and the other individual will walk toward the other end, unrolling the tape as he goes.
- When the other individual has reached the far end of the distance, he should lower the tape so that it rests on the ground, grasp it about 6" beyond the point to be measured and draw the tape taut (7-10 lbs. force with a steel tape, 2-3 lbs. force with a woven tape).
- When the tape is drawn taut, the person doing this should shout "ready", at which time the person at the other end will line up the zero point of the tape exactly on the point of origin for the measurement.
- When the tape is lined up at the point of origin, the person will shout "read", at which time the other person will read and record the measurement.

It is important that the tape be taut and levelly supported over the distance to be measured. In measuring distances longer than the tape length, a mark should be made at the end of each tape length and the distance written beside each mark (and recorded on paper). This mark serves as the start point for the next measurement until the total distance is measured, at which time all the partial measurements would be summed for the total measurement. Long measurements made off the pavement may involve the use of stakes to serve as marker points for successive partial measurements.

When working alone, the patrolman will need to use weights, pins, or nails as anchor points for his tape. Great distances (several hundred yards) are best measured by a surveyor. The patrolman should always be careful to wipe his tape before finally retracting and storing it.

In cases where the accuracy of measurements may be contested, it may be advantageous to repeat each measurement taken, reversing the roles of each individual taking the measurement. Steel tape measures are not absolutely accurate, they can stretch somewhat, e.g., 10 lbs. force on a 100' steel tape can cause it to stretch 1/4". Temperature can affect the accuracy to some degree, e.g., a temperature change of 100° can change the length of a 100' tape measure by 1".

If is very important to guard against the following kinds of human error in the taking of measurements:

- Reading numbers upside down (e.g., mistaking a 6 for a 9)
- Reading the wrong foot mark on the tape
- Misreading the zero point
- Losing count of the number of complete tape lengths involved in a long measurement
- Mistaking tenths of a foot for inches
- Forgetting to reset a measuring wheel to zero before using it

There are other techniques for taking measurements. A measuring wheel is a device with a calibrated wheel and a digital counter. The wheel is rolled on a level surface, and the distance it rolls reads out on the digital counter. It only gives accurate distance measurements for smooth, level surfaces. It is particularly good for measuring curved distances.

If an accurate measuring device is not available, distances may be paced off. The patrolman's normal pace or walking step is used and the distance is recorded as number of "steps," which are converted into feet at a later time. Another back-up technique for measuring short distances is footing. Here distances are recorded in "shoes" (placed end to end) and converted to feet at a later time.

Specific Types of Measurements

Location measurements. When taking measurements to locate a point, such as the point of initial impact or final resting place of a vehicle, the patrolman must be sure to "anchor" his measure to a geographically fixed and stable reference point or landmark such as:

- Roadway edge, using a pin or nail to make a fixed point
- Guard rail
- Utility pole
- Tree
- Fire hydrant
- Permanent road sign
- Manhole cover, etc.

Measurements should never originate from points which are unstable or could disappear, such as a pile of debris or a mailbox.

When attempting to measure the location of an item at the scene, there are several recommendations that should be kept in mind for handling various classes of objects. For small objects (e.g., bodies, short tire marks, vehicle parts, debris less than 4' in diameter), the approximate center point of the item should be used. Vehicles should be located by measuring to two or more points at each end of the vehicle such as two diagonal corners or two corners on one side. The corners should be well defined and not badly damaged. If the corners are badly damaged, one should measure to the center of the wheels.

Long marks on or off the roadway should be located by measuring to two points at each end of the mark. If the mark is curved, to accurately locate the position of the mark in the accident scene, several measurements will be needed. Typically, the roadway edge (if basically straight and well defined) is used as a line of origin for measurements to marks either on or off the road. A reference or zero point is established at the roadway edge by a measurement to an anchor point or landmark. From the reference point, measured intervals of at least 10-20' should be laid off and marked (crayon or pins) along the roadway edge to cover the length of the mark. Where a mark curves sharply, short intervals (3-5') may be needed to track the curvature of the mark accurately. Perpendicular measurements (with respect to the roadway edge) should be taken from each of the roadway edge origin points to the mark in question and recorded on the sketch of the accident scene. This is calledthe "coordinate method," and it may be used to locate other items in the accident scene as well. For loose debris/irregular areas, measurements should be taken to the center point of the concentration. If the area to be located is large and/or irregular in shape, several measurements should be taken to define the shape and area.

To locate a point in the accident scene with good accuracy, two measurements are required where there are not sharp, well-defined pavement edges. The technique involved is called the "triangulation method." If the measurements are made from two fixed anchor points of landmarks to the unknown point, the position of that point is fixed by the triangle. The distance between the two anchor points can be measured at the convenience of the patrolman, when the urgent aspects of the investigation are over. Triangles formed should be as broad as possible for the greatest accuracy; narrow triangles are to be avoided.

Auxiliary anchor points can be used which are measured point locations (e.g., pavement crack, crayon mark on pavement edge, etc.) from a fixed recognizable landmark (tree, lamp post, fire hydrant, etc.). Such auxiliary anchor points can always be relocated at a later date. Auxiliary anchor points should be used only when insufficient physical landmarks are available for a particular location measurement.

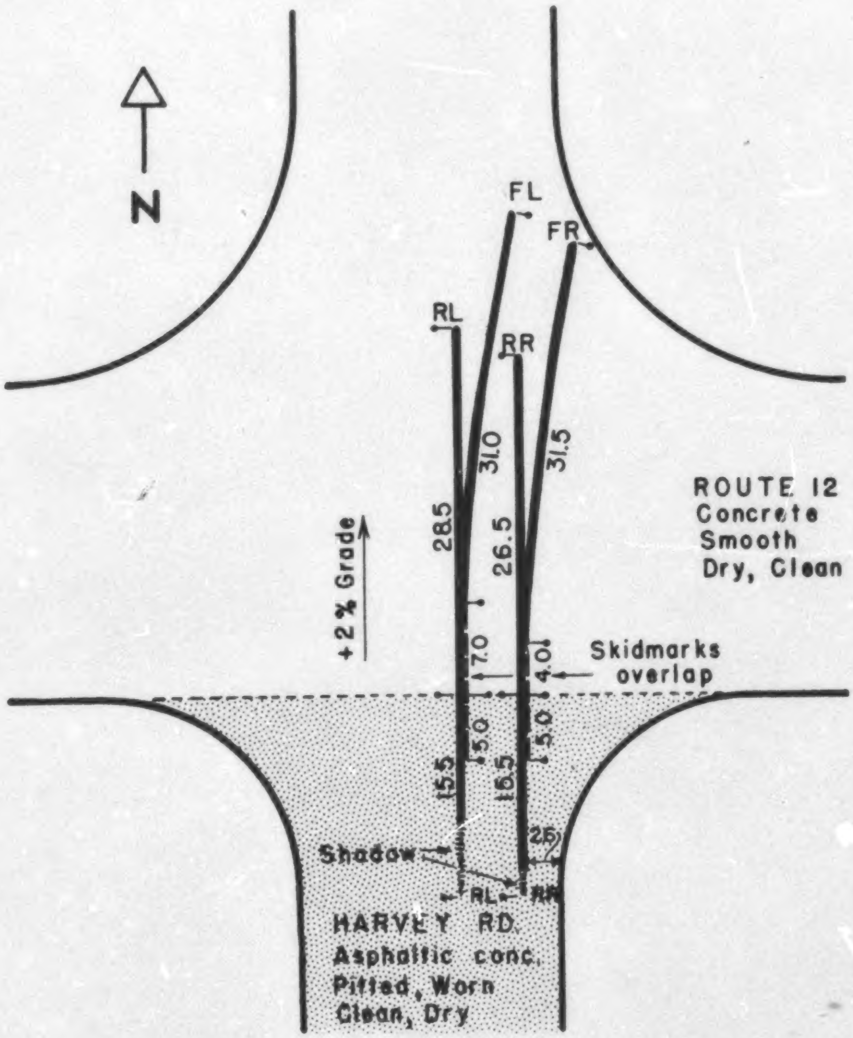
Skidmark measurements. Before taking any measurements, the location should be made of the beginning and end of each skidmark made by each wheel, and all gaps in between. There are two parts to most skidmarks. There is the probable part where there may be some question about whether the wheel was sliding, and the positive part of the skid which can be clearly identified. The patrolman should be primarily concerned with measuring the positive parts of skidmarks.

The basic procedures for measuring skidmarks are as follows:

- Mark the beginning and end of each skidmark with a crayon or some object and identify each skidmark with the wheel making it (e.g., FR, FL, RR, RL, in the case of a four wheel vehicle).
  - The patrolman should be careful to distinguish skidmarks from tire imprints
- Measure the length of the positive skidmark to the nearest half foot, and record for each wheel; show the length and location of each skidmark in the sketch/diagram.
- If the skidmark goes from one kind of pavement to another, measure the length of the skidmark on each kind of pavement. Study Guide Exhibit 5-15 gives an example.
- If there is a gap in the skid, not a skip, count this as two separate skids for measurement purposes.

Exhibit 5-15

Measurements for skidmarks on two types of pavement*


N
FL
FR
RL
RR
31.0
31.5
28.5
26.5
ROUTE 12
Concrete
Smooth
Dry, Clean
+2% Grade
7.0
4.0
Skidmarks
overlap
5.0
5.0
15.5
16.5
2.5
Shadow
RL
RR
HARVEY RD.
Asphaltic conc.
Pitted, Worn
Clean, Dry

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*Source: Exhibit 42-3, page 380, Traffic accident investigator's manual for police, © 1963 Northwestern University, Evanston, Illinois, used with special permission

- The total skidding distance would be the sum of the two skids

Study Guide Exhibit 5-14 shows the measurements associated with an overlapping skid. In measuring perfectly overlapping skids, one must subtract the vehicle's wheelbase (passenger car is approximately 10') from the total measured length to get the skidding distance. All four wheels must have skid and this can be verified by looking at burn marks on the tires. In most cases, perfectly overlapping skids do not occur; it is usually possible to identify where the rear wheel stopped, as this skid is usually off to one side and on top.

Study Guide Exhibit 5-16 shows the measurements for a hypothetical curved skid. The curved distance of each skidmark must be traced as well as possible to get the true skid distance. This can be done by placing the tape on its edge and shaping it to the contour of the skidmarks. The straight line distance between both ends will not be a good approximation if there is much curvature. A measuring wheel is an ideal tool for measuring curved skid distance on pavement. For dual tire skids, the two marks left on the road are considered a single skid. The patrolman should measure the longest overall skidmark for each set of wheels.

Accident Sketches and Diagrams

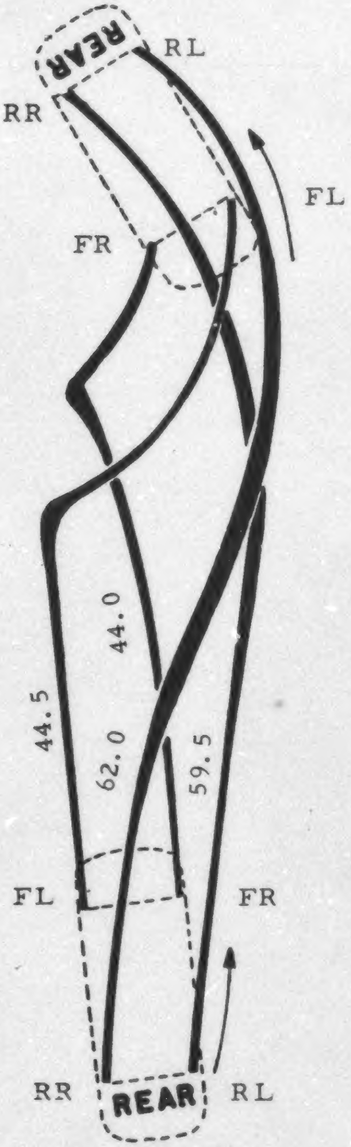
Field sketch. A field sketch is a freehand drawing of the significant items composing the accident scene. It should be made at the outset of the investigation, before any length or location measurements are made. It shows only factual, observable things, not suppositions or opinions on the part of the investigator. Measurements made should be reflected directly on the sketch. It should show the following accident related items, which should be clearly labeled, where necessary:

- Final position of vehicles, human and animal bodies
- Collapse of vehicles
- Skidmarks and other roadmarks present
- Traffic control devices present
- Type (s) of debris associated with the accident
- Landmarks and other origins of measurements
- Camera positions for any photographs taken
- Roadway edges, shoulders

The arrangement of the accident scene on the sketch, as well as the scale diagram, should be such that the direction of north will be toward the top of the page.

Exhibit 5-16

Curved skidmarks left by a half spin*


REAR
RL
RR
FL
FR
44.0
44.5
62.0
59.5
FL
FR
RR
REAR
RL

Note: The skid left by each wheel is measured separately by following the curvature of the skid.

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*Source: Exhibit 42-2, page 379, Traffic accident investigator's manual for police, © 1963 Northwestern University, Evanston, Illinois, used with special permission

It is helpful to compose a field sketch on graph paper having ten divisions to the inch. Should any mistakes be made on a field sketch, they should not be erased, but should be crossed out and a note made as to why the corrections were necessary. A completed field sketch should always show the following identifying information:

- Municipality in which accident occurred, or name of interstate highway
- Day and hour of accident
- Accident scene localization, e.g.,
  - Street/road names involved approximate
  - Distance from known intersection, overpass, exit number, etc.
- Landmark/anchor point identification (s)
- Direction of north
- Name (s) of person (s) who made the measurements and prepared the field sketch
- Legend depicting the meaning of any symbols used in the sketch

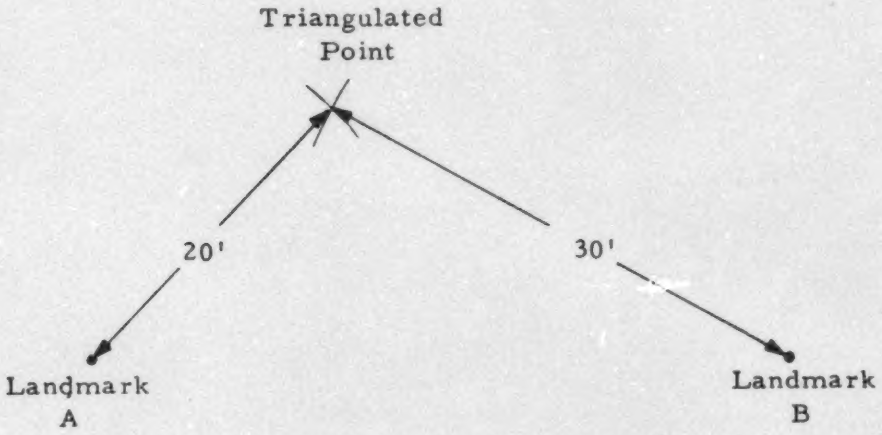
A field sketch should be compared with a photograph taken of the accident scene for consistency. The field sketch, though a preliminary record, must be available with other police accident records for possible court presentation.

Scale diagram. The patrolman may wish to formalize the information contained in a field sketch by preparing a scale diagram. The basic implements needed to prepare a scale diagram are a straight edge, graph paper (10 lines to the inch), compass, template (if used). The precise shape of roadway contours involved may be obtained from street and highway drawings already on file with the city, county, or state highway engineering office. Prints of maps of interest to the patrolman may be secured. When planning the scale diagram, it should be remembered that a good scale diagram will have:

- Lines to show relative positions of objects with respect to trafficway contours
- Symbols to represent common objects
- Brief, descriptive wording for identification
- Numbers for identification and dimensions
  - Scale diagrams will have fewer dimensions identified than field sketches

A drawing compass is helpful to transfer measurements from a field sketch on to the diagram. If working with a scale of 10 feet to the inch, each division on the graph paper will represent one foot. In the case of a triangulated measurement as an example, if one measurement is 20 feet from one landmark and the other is 30 feet from the other landmark, the following procedure is employed:

- Open the compass to two inches in width, place the point on the appropriate landmark and draw a small arc between the two landmarks
- Open the compass to three inches in width, place the point on the appropriate landmark and draw an arc which intersects the other arc
- Where the two arcs intersect is the point located by the triangulated measurement (see the drawing below)



The compass can also be used to scale off distances measured using the coordinate system.

The completed diagram should contain the following identifying information:

- Municipality in which the accident occurred
- Day and hour of accident
- Road area identification (street/route names) and indication of any grade present
- Landmark/anchor point identification (s)
- Direction of north
- Name of person who prepared the scale diagram
- Date on which the scale diagram was prepared
- Reference to the field sketch on which the scale diagram is based
- Clear, succinct labels for the final positions of all objects and roadmarks located in the accident scene by measurements (e.g., vehicle makes, types of traffic control devices, roadmarks, types of debris, etc.)
- Legend depicting the meaning of any symbols used in the diagram
- Scale of the diagram, e.g., 1 inch = 10 feet, 1 inch = 20 feet plus a graphic depiction of the interval scale

Both the field sketch and scale diagram must be carefully preserved with the rest of the accident records and evidence.

Procedures for Conducting Test Skids

To make accurate estimates of minimum vehicle speed from skidmarks, it is necessary to know how slippery is the surface of the pavement. This can best be accomplished by making a test skid at the scene to determine the drag factor.

The ideal situation (liability considerations permitting) is to use the accident vehicle (if operable) to make the test skids. The permission of the owner could be obtained by asking him, "may I test the brakes on your car?" If the accident vehicle is incapacitated, then a vehicle of similar weight and tire condition should be used. The greatest of precautions should be exercised in conducting test skids. If weather conditions are hazardous, a test skid should not be attempted. When weather conditions are marginal, a low speed skid may be attempted (20 mph or less). The patrolman should be sure that any test skid made does not violate or obscure an accident skid. If two types of pavement are involved in the accident skid, separate test skids should be made on each kind of pavement.

In making a test skid, it is first necessary to select a safe area to conduct the test skid, as near the accident scene as possible. Next the speed for the test skid should be selected. It is usually not safe to select the estimated accident skid speed. Generally a speed of 35 mph or the speed limit, if less, is satisfactory; whatever speed is selected it should be an even speed like 20, 25, 30 mph. After the vehicle is correctly positioned to make the test skid, the patrolman should start the run and adjust vehicle speed about 3 mph faster than the desired test skid speed. Following this, he should release the accelerator pedal and wait for the speed to drop to the desired speed. When the desired speed is reached he should jam on the brakes suddenly and hard, and hold the brakes down until the vehicle stops. The actual speed at which braking is begun should be noted and recorded. If possible, a second test skid should be run for comparison purposes. The previous procedure can also be used to test a brake system where its functioning may be suspect as a result of an absence of skidmarks at the scene of a collision.

The length of test skidmarks should be measured and recorded in the same manner as for accident skids. It is also important to note and record in connection with the test skid:

- Any grade or slope present (which can be measured later)
- Pavement type and condition
- Loose material on the pavement surface, if any.

Knowing the length of the test skid and the speed at which it was made, the drag factor or slipperiness can be determined from the "Speed Nomograph." (See Exhibit 5-17).

ACCIDENT MANAGEMENT PROCEDURES, PART VII
ESTIMATING SPEED FROM THE PHYSICAL EVIDENCE

Introduction

Rarely can the speed before collision be accurately known. It can only be estimated from such information as:

- The statements of drivers and witnesses
- Vehicular damage
- Road marks
- Movement of vehicles after the key point or point of maximum engagement

Since the information about vehicular speed, as reported by people, is subject to personal bias and judgmental error, this unit will concentrate on the methods for estimating speed from the physical evidence at the scene.

Estimating Vehicular Speed from Incurred Damage

If the damage to a vehicle is extensive, the speed and/or weight of one or more collision units must have been significant. If the damage is slight, the speed and/or weight of one or more vehicles must not have been great. Vehicular parts resist the forces of collision as a function of their inherent strength. Sheet metal parts (e.g., fenders, hood, doors, and other body parts), glass and the trim are easily damaged. Bumpers can resist more force, however as presently designed (circa 1972), they offer little real impact resistance. The strongest parts are the wheels, wheel supports, frame, etc. The frames of passenger cars are susceptible to damage and collapse from side forces; moderate collision speeds can cave in the sides of cars. A head-on collision results in the least collapse for the amount of speed involved because the strong parts such as the wheels and frame are quickly engaged. A weakly constructed vehicle will show the most damage. In some cases, a fairly accurate estimate of vehicular speed at the time of collision can be made from an analysis of the resultant damage. However, this is a job for a technical expert.

Estimating Vehicular Speed from Skidmarks

Speed can be more easily determined from such road marks as skidmarks and scuffmarks. Speed determination from skidmarks will be the concern of this discussion.

The length of skidmarks never indicates all of the vehicular speed prior to the collision. A calculation of speed based on the length of a skidmark will indicate how fast a vehicle was going to be able to slide to a stop in the distance indicated by the skidmark. The vehicle is always going faster than the speed indicated by the skidmark; it can lose speed in one or more of the following ways before stopping.

- During braking without skidding, e.g.:
  - Before the skid begins
  - During gaps in skidmarks
  - After skidmarks end
- While skidding with one or more wheels before a skid becomes apparent
- While striking objects en route to the skid or collision
- When striking an object in the final collision before the skid alone would have stopped the car
- During vaulting or rolling

When a skid terminates in a collision, to estimate the speed before the skid began, the speed lost during the skid must be combined with the speed lost during the collision. A skidmark may only be a few feet in length, indicating a slow speed. However, the vehicular damage associated with the short skid may be extensive, indicating much greater speed. In accidents where there is a great deal of vehicular damage, skidmarks generally show a small percentage of the speed before braking. In accidents where most of the speed was lost in the skid, one can calculate a pretty good estimate of how fast the vehicle was going just before the skid.

How far a car skids on four locked wheels depends on three factors that must be considered whenever evaluating skidmarks for vehicular speed:

- Pre-skid speed of the vehicle

- Drag factor or coefficient of friction (e.g., resistance to skidding or sliding on whatever surface the vehicle is on)

- Slope or grade of the surface (up or down)

Procedures for Estimating Speed from Skidmarks

It should be emphasized that only an estimate of speed will be obtained and that since skidmarks generally will not show all of the vehicular speed, the speed estimate obtained will probably be lower than the actual speed. Listed below are the basic procedures for estimating speed from skidmarks:

Obtaining the length of the accident skid, based on careful field measurements. For straight skids, use the length of the longest skidmark left by any one wheel, minus the length of any gaps that may be present. For curved skids, add the skidmark lengths for all wheels and divide by the number of wheels if the weight is about equally distributed between the front and back wheels (such as in passenger cars, motorcycles, light trucks, or lightly loaded big trucks). This method does not apply to heavily loaded trucks with dual tires on the rear wheels or tractor trailer trucks; these situations require a special calculation. For overlapping skids, the total length of the skid minus the length of the wheelbase is used.

Determining the drag factor for skidding tires. The drag factor is affected by such conditions as:

- Material on the pavement surface
  - A clean surface has more drag than a surface covered with sand, rain or snow
- Length of the skid
  - Long slides have a lower drag factor than short ones, due to the fact that tires heat up and become more slippery as they slide
- Tire tread

  - On a smooth clean surface there is little difference in drag between a "bald" tire and a heavily treaded tire
  - If there is a slippery film on the pavement surface (water, snow, etc.) the heavily treaded tire will have more drag and skid resistance

- Ambient temperature
  - In general, hot weather causes longer stopping distances than cool weather

- Vehicular weight
  - Generally, heavier vehicles will skid farther than lighter vehicles

- Tire orientation
  - A tire will skid about as far lengthwise as sidewise in most cases
  - In soft ground material, a sidewise skid will cause more material to pile up in front of the tires, causing a shorter skid than would occur on solid pavement

- Wind
  - The effects of "head" and "tail" winds can affect the length of skid somewhat

The drag factor for a given accident scene and vehicle can be calculated by using the following formula:

$$F = 0.033 \times \frac{s^2}{d}$$

, where F = drag factor, s = speed of test skid (mph) and d = length of that skid (ft.)

As an example, for a d=30 ft. and an s=20 mph, the calculation of F can be performed in the following manner:

$$F = 0.033 \times \frac{s^2}{d}$$

$$F = 0.033 \times \frac{(20)^2}{30}$$

$$F = 0.033 \times \frac{400}{30}$$

$$F = 0.033 \times 13.3$$

$$F = .4389$$

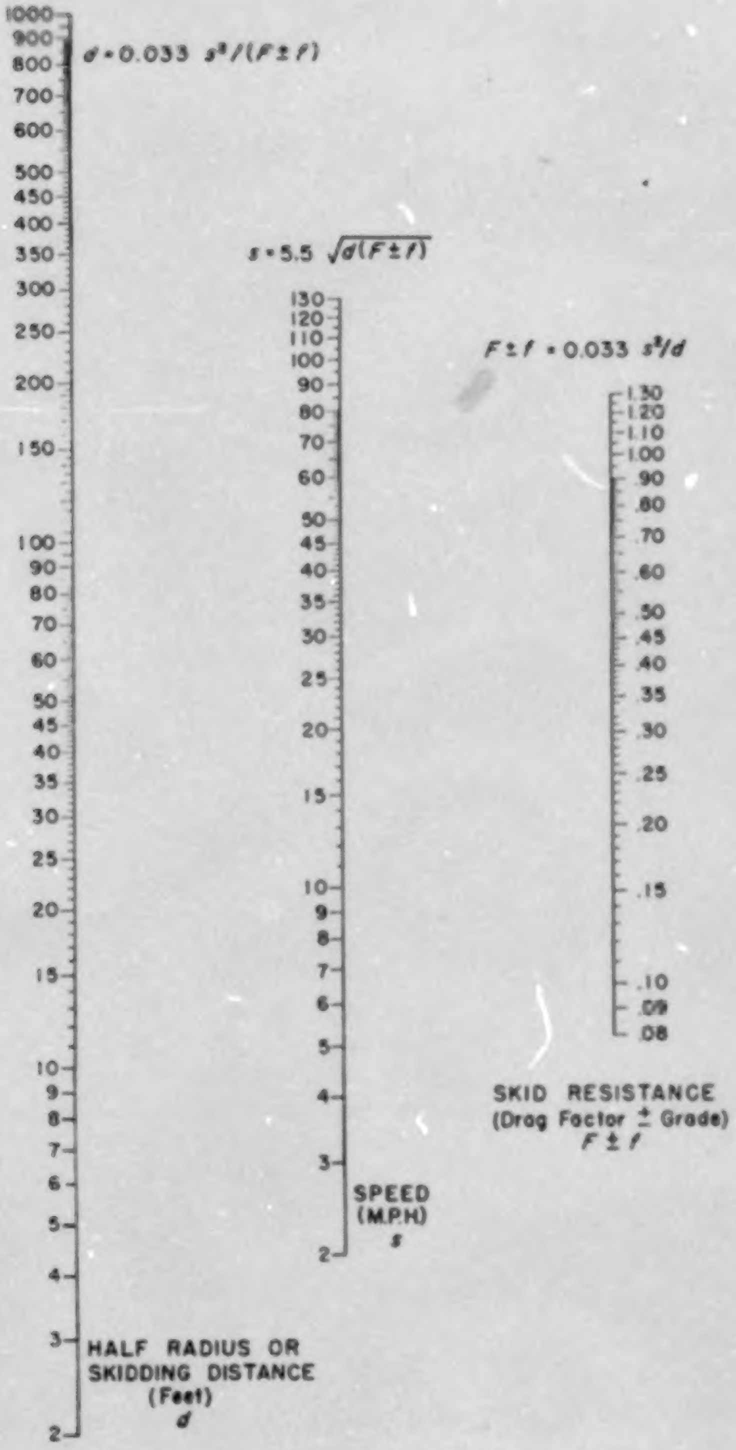
The drag factor can also be determined from the "speed nomograph" which is shown in Study Guide Exhibit 5-17. The speed nomograph is a scientific chart which was constructed based upon certain physical laws. It can be used to determine the drag factor instead of making the previous calculation. The procedures are as follows:

- Locate the test skid distance on the "d" scale
- Locate the test skid speed on the "s" scale
- Position a straightedge between these points on the "$F \pm f$" scale to get the drag factor

If more than one test skid is analyzed to determine the drag factor, the lowest drag factor obtained should be used if one wishes to be sure that the calculated speed is the most "conservative" estimate. Often, for numerous reasons, a test skid is not made. Study Guide Exhibit 5-18 is a table which presents a range of typical drag factors for common road surfaces and represents the average of many tests run. These drag factors may be used in the absence of a calculated drag factor, to give a rough approximation of minimum speed. In any speed determination, both the low and high drag factors for a given roadway surface should be used to establish a possible speed range.

Exhibit 5-17

Speed nomograph*



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*Source: Exhibit 52-9, page 517, Traffic accident investigator's manual for police, © 1963 Northwestern University, Evanston, Illinois, used with special permission

Exhibit 5-18

Possible ranges of pavement drag factors for rubber tires*

Description of Road Surface	Dry				Wet			
	Less Than 30 m.p.h.		More Than 30 m.p.h.		Less Than 30 m.p.h.		More Than 30 m.p.h.	
	From	To	From	To	From	To	From	To
Portland cement								
New, Sharp	.80	1.20	.70	1.00	.50	.80	.40	.75
Travelled	.60	.80	.60	.75	.45	.70	.45	.65
Traffic Polished	.55	.75	.50	.65	.45	.65	.45	.60
Asphalt or Tar								
New, Sharp	.80	1.20	.65	1.00	.50	.80	.45	.75
Travelled	.60	.80	.55	.70	.45	.70	.40	.65
Traffic Polished	.55	.75	.45	.65	.45	.65	.40	.60
Excess Tar	.50	.60	.35	.60	.30	.60	.25	.55
Brick								
New, Sharp	.75	.95	.60	.85	.50	.75	.45	.70
Traffic Polished	.60	.80	.55	.75	.40	.70	.40	.60
Stone Block								
New, Sharp	.75	1.00	.70	.90	.65	.90	.60	.85
Traffic Polished	.50	.70	.45	.65	.30	.50	.25	.50
Gravel								
Packed, Oiled	.55	.85	.50	.80	.40	.80	.40	.60
Loose	.40	.70	.40	.70	.45	.70	.45	.75
Cinders								
Packed	.50	.70	.50	.70	.65	.75	.65	.75
Rock								
Crushed	.55	.75	.55	.75	.55	.75	.55	.75
Ice								
Smooth	10	.25	.07	.20	.05	.10	.05	.10
Snow								
Packed	.30	.55	.35	.55	.30	.60	.30	.60
Loose	.10	.25	.10	.20	.30	.60	.30	.60
Metal Grid								
Open	.70	.90	.55	.75	.25	.45	.20	.35

The actual drag factor or coefficient of friction of a pavement of a given description may vary considerably because quite a variety of road surfaces may be described in the same way and because of some variations due to weight of vehicle, air pressure in tire, tread design, air temperature, speed and some other factors. These figures represent experiments made by many different people in all parts of the U.S. They are for straight skids on clean surfaces. Speeds referred to are at the beginning of the skid.

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*Source: Exhibit 52-8, page 516, Traffic accident investigator's manual for police ©1963 Northwestern University, Evanston, Illinois, used with special permission

Determining the skid resistance for skidding tires. The total skid resistance is equal to the drag factor plus the positive or negative effect of any grade present which can be expressed as "$F \pm f$", where $\pm f$ is the % grade--"+" if uphill, "-" if downhill.

"f" is defined as the number of feet the road rises or falls for each hundred feet of road surface (i.e., "% grade"). For example, if the road rises 2 feet over a level distance of 50 feet,

$$f = \frac{2}{50} = +0.04.$$

f is usually less than 0.10, unless the grade is very steep. f must be added to or subtracted from the determined drag factor to get the skid resistance, i.e., $F \pm f$. For example, if the drag factor is 0.95 and the % grade is + 0.07, then the total skid resistance would be 1.02.

Determining the minimum speed for the accident skidmark. If the drag factor, % grade, and distance of the accident skid are known, then the calculation of minimum speed for that skidmark can be made by the use of the following formula:

$$S = 5.5 \sqrt{d\,(F \pm f)},$$

where S = minimum speed (mph)

d = accident skid length (ft.) and

$(F \pm f)$ = total skid resistance

As an example, for a d = 48 ft., and an $F \pm f = 0.75$, the calculation of S can be made in the following way:

$$S = 5.5 \sqrt{d\,(F \pm f)}$$

$$S = 5.5 \sqrt{48 \times 0.75}$$

$$S = 5.5 \sqrt{36}$$

$$S = 5.5 \times 6$$

$$S = 33 \text{ mph}$$

The speed nomograph (Study Guide Exhibit 5-17) can also be used to determine the minimum speed, using the following procedure:

- Locate the accident skid distance on the "d" scale
- Locate the skid resistance on the "F ± f" scale
- Position a straightedge between these two points
- Where the straight line intersects the "S" scale is the minimum speed for the accident skidmark

General Comments on the Analysis of Skidmark Evidence

It must be emphasized that one cannot positively determine how fast the vehicle was going before the accident, by skidmark evidence alone. One can only say that the speed determined from skidmark evidence is a minimum speed, and that the vehicle must have been going faster because of the speed lost to braking before skidding and the speed lost in any final collision. The speed calculated from skidmarks does indicate "the speed which the car would need to slide to a stop in the distance shown by the skidmarks."

ACCIDENT MANAGEMENT PROCEDURES, PART VIII
PHOTOGRAPHING THE ACCIDENT SCENE

Introduction

Photographs are a forceful and convenient means of recording the physical conditions of the accident scene. They can supplement but not supplant other forms of documentation, such as careful observation of the accident scene and measurement and diagraming of the accident scene events and objects. Photographs may capture some aspect of the scene which was overlooked by the investigator while under duress. A picture may help clarify some point that the investigator or someone else may want to know at a later time.

A study of the photographs can help in reconstructing the accident. They help the investigator as well as expert analysts to arrive at conclusions about the accident. The photographs may also be used by the prosecutor as evidence to prosecute traffic violators. They may be introduced as critical evidence in setting claims for damages resulting from the accident.

Use of the Camera

Background. A patrolman cannot legally be prevented from taking pictures on public property. However, the laws of trespass may prevent him from taking pictures on private property. If an accident occurred on private property, legally, the patrolman cannot take a picture on the property without the owner's permission; but, it would be perfectly legal to take a picture of the scene from a public road. Someone attempting to prevent a patrolman from taking a picture on public property is interfering with the patrolman's performance of duty and this could be considered a misdemeanor. Pictures should be taken as soon as possible after arriving at the accident scene since the situation is likely to change as time goes on, i. e., short-lived evidence may be obliterated or removed.

When and what to photograph. When and what to photograph normally depends on the urgency of higher priority tasks, such as caring for the injured or maintaining a traffic flow and control of bystanders. However, when no one is injured and wrecked cars must be moved to clear the road, photographing the accident scene may be one of the patrolman's initial tasks. Initially, one should photograph information that may be quickly lost, such as:

- Debris which shows the point of impact (e.g., broken glass, dirt which fell from the underside of the vehicles, etc.).

- Tire imprints or skidmarks in soft material (i.e., dirt, mud, snow, etc.), which may be disturbed or obliterated due to traffic, weather, and/or persons at the scene.

Later, photograph more permanent evidence, such as roadside objects, view obstructions, position of traffic signs. Damage to vehicles may show up better after they have been removed, especially if the vehicle ran off the road and turned over. However, make note of any damage or physical change to the vehicle photographed which resulted from moving the vehicle or rescue operations (e.g., windows were broken in order to rescue occupants, spare tire substituted to facilitate towing, etc.).

Commonly photographed accident situations. The following are examples of situations where photographs are of particular value to assist the patrolman in reconstructing the accident and forming opinions.

- Accidents involving fatalities
- Accidents where a large vehicle such as a truck or bus ran off the road or roadway
- Accidents involving vehicles which ran off a bridge or through a guard rail
- Accidents at railroad crossings
- Accidents involving pedestrians
- Hit and run accidents
- Unusual/freak accidents, such as a vehicle colliding with an airplane

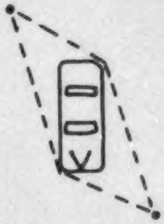
General Rules

Background. Photographs are not always necessary, especially if the accident is minor; but when in doubt, they should be taken if the patrolman has a useful objective in mind. Keep the number of photographs to a minimum, since too many photographs waste valuable time and film.

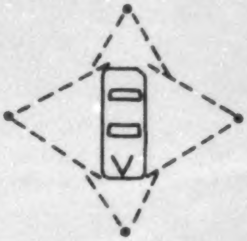
Photographs showing details of vehicular damage are good, however, close-up photographs of bodies and blood are usually of little value.

Plan the pictures. The patrolman should plan the type of picture he wants before setting up the camera. Good planning will eliminate the need to take several photographs when one good photograph will do. Plan pictures so as to include not only objects of interest, but their relationship to other accident scene objects. The patrolman should attempt to make the photograph show as much as possible. Exclude extraneous items insofar as possible. Ask bystanders to step out of the field of view as they may detract from the photograph and pose additional problems if the photograph is used in court.

Photographing vehicular damage. Photographs of vehicular damage are useful in reconstructing the accident. To reflect the extent of total vehicular damage, a minimum of two oblique pictures are required, as illustrated below, to show all four sides of the vehicle:



However, oblique pictures should only be taken when time is a factor, since they do not reflect the extent and direction of collapse. The best illustration of vehicular damage is where four pictures are taken with each aligned with the axis of the vehicle, as illustrated below.



It is best to photograph vehicular damage before the vehicles are removed, so that towing-incurred damage will not interfere with the patrolman's analysis of the accident. To present a true representation of the accident, photographs should include detached vehicular parts where they were found in the roadway. If possible, photographs of the final resting places of the vehicle should include recognizable landmarks.

Roadmarks/Tire marks. Photographs of roadmarks (gouges, scratches, etc.) and/or tire marks are excellent supplements to physical measurements. Some of the patrolman's considerations for photographing these marks are reviewed below:

- Aim the camera at the roadmarks/tire marks and no closer than 3 feet above the ground.
- At least one of the roadmarks/tire mark pictures should show a large road area to prove that other marks have not been intentionally omitted.
- At night, several synchronized flash sources may be needed if the roadmarks/tire marks are long. Generally a single flashbulb is sufficient to illuminate marks up to 25 feet long; beyond that, additional synchronized sources are required every 25 feet.

Final position of objects. The final position of vehicles and objects must be measured and diagramed. However, photographs are excellent supplements to this information.

Roadway environment. Photographs of the trafficway environment are useful, only if they are intended to document some of the following factors:

- View obstructions
- Sight distances
- Position/condition of traffic control devices
- Roadway irregularities
- Possible illusions or interferences with vision
- Road surface deficiencies
- Other conditions showing a direct bearing on the accident

General Techniques

The following are general techniques employed to photograph an accident scene.

- Black and white film is desirable since it is quite satisfactory for documentary purposes, and easier and faster to process than color film. It also offers greater flexibility with available light. Color film rarely enhances accident scene photographs. It is used for recording paint rub-off and traffic control devices.

- For most pictures the camera should be held level to avoid distortion of perspective. Tilting, swinging and/or rotating the camera can give the wrong perspective of the actual environment. It can make a graded road look level.

- Bystanders should be asked to stand aside to avoid obstructing the view.

- Depth of field must be adequate to record all desired objects in focus.

- During daylight, flash may be used to fill in details shielded from available light.

- When photographing small objects, a scaled ruler or an object of known size should be placed next to the object being photographed.

Categorization and Preservation of Photographic Evidence

The patrolman must make a record of certain facts after taking each picture. For example, the following information is normally recorded:

- Location of the scene or objects photographed

- Compass direction of each photograph

- Identification number of the camera

- **Type of film used**
- **Type of lens used (if variable)**
- **Type of filter used, if any**
- **Settings employed (e.g., f-stop, focal distance, etc.)**

ACCIDENT MANAGEMENT PROCEDURES, PART IX
TAKING LAW ENFORCEMENT ACTION

Attitudes Toward Law Enforcement Action at the Accident Scene

The patrolman should be mindful that enforcement action at the scene of an accident, where warranted, is a primary objective of accident investigation. The opportunity to take law enforcement action at the scene must not be overlooked, for in a majority of traffic accident cases, at least one driver is guilty of committing one or more traffic violations. In the case of an apparent accident causing violation, the law enforcement action taken by the patrolman at the scene provides a singular opportunity to show people the direct connection between an alleged traffic violation and an accident. More specifically, the violator may be informed of the alleged violation he has committed, understand how it may have contributed to the resultant injury and property damage, and know that he is accountable to the public for his actions on the highway. Accident scene law enforcement action will also have a deterrent effect on those parties not directly involved in the accident and cause them to be more conscious of their driving behavior. Accident scene law enforcement action will support the accident prevention program by identifying accident susceptible individuals and enabling the "point system" to work effectively in causing suspension/revocation of chronic traffic offenders' driving licenses.

The patrolman should never assume that once a violation has been found, that this is the end of his enforcement responsibilities. He should be alert to detect multiple violations (possibly involving more than one principal) and take the appropriate law enforcement action for each offense. The concern should be with detecting and enforcing not only "hazardous violations" that may have contributed to the accident, but other law violations that are incidental to the accident (e.g., unauthorized use, stolen merchandise, defective equipment, etc.).

Public attitude. The public oftens expects that since there was injury and property damage associated with an accident, that sympathy and kindness should be forthcoming from the patrolman, not a citation or an arrest. Again, the patrolman is in a unique position to inform the public through his at-the-scene law enforcement efforts, that sympathy and kindness would not be necessary if a hazardous traffic violation had not been committed in the first place. Furthermore, the patrolman has a sworn obligation to uphold and enforce the law, no matter what the circumstances.

Traffic Accident Law Enforcement Policy and Procedures

"On-view" versus "investigative" enforcement. Normally, the patrolman takes law enforcement action as a result of observing the commission of an infraction and being able to account for all the elements of the offense. This has been termed "on-view" enforcement. A thorough traffic accident investigation, among other things, enables the patrolman to "discover" a violation by uncovering the elements of a contributing or associated offense. This has been termed "investigative" enforcement. Support for the discovery of a violation will come from all accumulated evidence, namely, the patrolman's observation of driver/pedestrian condition and the physical conditions and circumstances surrounding the accident, as well as the statements of witnesses, passengers and drivers as to what happened.

Violations at the scene of an accident. The patrolman should be particularly attentive to uncover evidence to support the commission of the following violations frequently associated with traffic accidents:

- Speed too fact for conditions
- Failure to yield right-of-way
- Failure to keep safe distance (following too closely)
- Drove left of center
- Made improper turn
- Improper overtaking
- Improper lights; defective brakes or steering
- Ignored traffic control device
- Drive while under the influence of alcohol or drugs

Support for taking law enforcement action. In addition to the statements forthcoming from people at the scene of an accident, the physical evidence present can provide additional support for taking law enforcement action. Listed below are several categories of traffic violations along with possible sources of information to support law enforcement action.

- Hazardous violations
  - Speeding
    - Minimum speed can be estimated from any skidmarks present
  - Traffic signs, signals and markings
    - Can be supported by the location of skidmarks and/or the point of impact
  - Right-of-way, wrong side, wrong way, overtaking
    - Can be indicated by the location of skidmarks or tire prints associated with the offending vehicle, or the position of debris locating the key event
  - Driving under the influence of alcohol or drugs
    - Patrolman's observation of behavior to support reasonable grounds/probable cause for arrest; pre-arrest breath screening test, if used
    - Physical evidence of use
  - Following (too closely)
    - Relative positions of vehicles and nature of damage sustained
    - Location of skidmarks present
  - Defective brakes
    - Test skids conducted/brake tests
- Non-hazardous/other violations
  - Inspection/testing of vehicle components
- Criminal acts
  - Unauthorized use/stolen vehicle
    - Registration check

- Stolen merchandise
  - Vehicle contents/debris on roadway

Taking law enforcement action. The procedures for taking law enforcement action (e.g., making traffic arrests, issuing citations and warnings) at the scene of an accident are basically the same as for any roadside situation. In the case of an arrest for driving under the influence of alcohol or drugs, the patrolman should consider requesting outside police assistance to process the suspect (e.g., booking, charging, chemical tests at headquarters) while he remains on the scene. If the patrolman has taken law enforcement action at the scene, he should make it clear to the individual(s) involved that such action was not taken as punishment for being involved in a traffic accident, but for violating a specific law. The time taken to explain this point will do much for furthering good public relations. If a citation has been issued, the patrolman should be sure that the violator knows why he was cited and what his obligations are regarding fines and/or court appearances, before the violator leaves the scene.

Terminal Accident Management Activities

Any law enforcement action taken at the scene of an accident normally terminates the patrolman's major accident management responsibilities. However, before leaving the scene of an accident, he should be sure to accomplish or arrange for the accomplishment of the following tasks:

- Verify that all requisite forms have been completed and distributed, as the case may be.
- Ensure that all physical evidence collected has been properly marked and stored.
- Return the license, registration, and all other official documents to those individuals who may leave the scene. Be sure to offer directions to those who may not know the way to resume their journey.
- Verify that all the personal property of injured or deceased individuals is properly marked and safeguarded for transport.

- Check to see that all of the patrolman's equipment (e.g., tape measure, blanket, flashlight, etc.) has been returned to the patrol car.

- Verify that the roadway is in such a condition as to allow for safe passage of traffic. Where serious damage has been done to the roadway and repair will be delayed, the area should be conspicuously marked (flares, barricades, lanterns) to allow safe passage of traffic. Report all damage done to trafficway equipment/facilities (especially traffic control devices) so that prompt repair may be effected. Remove all hazardous debris including disabled vehicles, from the road. Remove and dispose of all warning signals (flares, fusees) no longer serving a useful purpose. Report to the dispatcher before leaving the accident scene.

Section 6.0

TRAFFIC COURT

PREPARATION FOR TRAFFIC COURT

Background

When law enforcement action taken by the patrolman ultimately results in trial action against the accused, the patrolman will have the responsibility to assist in the prosecution, or in some cases, conduct the prosecution himself. The patrolman's role in the prosecution will entail the introduction of competent, relevant, and material evidence in support of the State's/People's case against the accused. Such evidence will take the form of the patrolman testifying on his observations of the circumstances surrounding the traffic offense, the procedures employed to gather evidence, the procedures employed to maintain the chain of any physical evidence processed, as well as his presenting and discussing any documentary evidence (e.g., citations, accident report, alcoholic influence report, etc.) and physical evidence.

A successful prosecution of a traffic offense is generally the result of an adequately prepared case. In cases involving on-view enforcement action, a great part of the State's /People's case will involve an account of the patrolman's observations of an infraction. Generally, there will be a requirement for more careful and thorough preparation in court cases involving investigative enforcement. This is due to the likelihood that the patrolman did not witness a violation but had to amass evidence to discover the violation. Great reliance will have to be placed upon the statements of witnesses and on interpretations of the physical evidence. Especially careful preparation is generally required for serious offenses involving traffic arrests, such as driving while under the influence of alcohol or drugs, reckless driving, "hit and run" (leaving the scene), and vehicular homocide.

The patrolman's preparation for any resultant trial action begins at the time he takes law enforcement action in the field. Regardless of whether on-view or investigative law enforcement action is taken, he must be careful to identify all the elements of the offense and be sure that he has unassailable evidence to support each element of the offense; a large part of the effectiveness of any prosecution rests on the patrolman's competence in this regard. The elements of each traffic offense are fixed, but the evidence to support the elements may vary from situation to situation. The evidence with which the patrolman will be concerned may include:

- Roadmark measurements (length, evaluation) and other physical evidence (e.g., vehicular parts, liquor bottles, etc.)
- Statements of principals and witnesses at an accident scene
- His observations made (from memory and/or field notes) of illegal driving and the behavior of individuals suspected to have been driving while under the influence of alcohol or drugs

- Documentary evidence prepared (i.e., departmental forms such as arrest record, citation summons form, alcoholic influence report form, refusal form, etc.)

The patrolman must be absolutely sure that he has followed departmental procedures in support of his law enforcement actions. He will be called upon in court to state how he accomplished various law enforcement procedures such as the following:

- Measuring the location and lengths of items on the trafficway
- Pacing/clocking of the speed of a vehicle
- Administering performance/psychomotor tests to persons suspected of alcoholic or drug influence
- Collecting bodily speciments and other physical evidence (urine, breath, blood) for laboratory analysis and maintaining the chain of evidenc
- Arresting and processing of suspects

He must understand the built-in safeguards in departmental SOP (safeguards against human and equipment error, violation of court precedents and the constitutional rights of citizens) for law enforcement procedures so that, to the best of his ability, he may defend his actions against attack by defense counsel.

All departmental forms completed by the patrolman must be properly executed; any errors, as unimportant as they may be, will be seized upon by defense counsel as part of his overall program to destroy the patrolman's credibility in any way that he can.

Review of the Case before Trial

Before going to trial, the patrolman should obtain and become familiar with all the relevant evidence surrounding the offense (s), such as:

- Field notes taken
- Forms completed (e.g., arrest reports, citation form and "back-up" account, accident reports, witness statements, etc.)
- Physical evidence collected (e.g., photographs, vehicular parts, measurements, liquor bottles, etc.)
- Written results of laboratory tests of specimens collected in the field

If a prosecuting attorney is available for pre-trial consultation, the patrolman should review the case with him, covering such points as:

- What evidence is admissible
- Weaknesses and strengths of evidence
  - Possible defense counsel attacks upon the accummulated evidence should be anticipated
  - Any weak evidence should be discarded
  - In cases involving the testimony of witnesses, such witnesses should be interviewed and briefed on courtroom procedures
- The need for "expert" testimony
  - Depending on the nature of the evidence involved and jurisdictional requirements, the interpretation of some evidence may have to be made by an expert witness
  - Expert witnesses may be civilians or police personnel who, by virtue of their experience and training, are qualified in the court's mind to give their evaluation and interpretation of factual material (e.g., speed from skidmarks, impairment for certain BAC's, etc.)
- Boundaries of the patrolman's testimony
  - It should be clearly understood just in what manner and to what extent the patrolman should give testimony
  - Generally, the patrolman may only testify as to what he has personally witnessed or done
  - He should never offer hearsay accounts of events
  - He should never offer his opinions or evaluations unless he is qualified and asked to do so

All evidence to be introduced should be organized and readily available at the time of trial. In investigative enforcement cases, it is particularly important for the patrolman to testify only on what he has witnessed or done and knows for a fact rather than what he thinks he knows based on the statements of principals and witnesses at the scene of an accident. When asked to tell the court about what he knows about the violation committed, the patrolman should begin with what attracted his attention to the violation and, in chronological order, what he perceived and did until contact with the violator was broken.

APPENDIX A

REFERENCES

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